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ABSTRACT

Conference goals included identifying projected technical manpower needs and skill mix requirements, potential obstacles to developing an adequate technical education base, and stimulating education, industry, and labor cooperation in technical program development and federal interagency coordination and cooperation. Findings of the conference indicated: national data rarely reflected local employment demands; proprietary concerns of employers restricted access to employment trend data; limited exchange of energy-related skill supply data was evident between colleges; college intake and placement policies restricted opportunities to meet regional and national needs; uniform energy occupational categories were lacking; high technology programs required equipment and facilities that were too costly for most colleges; federal funds tended to favor start-up support rather than to strengthen existing programs; and industrial employers did not universally accept that colleges produce quality employees. Recommendations for ameliorating these problems are made. Reports on technology workshops in the coal, nuclear, petroleum, and solar energy fields include a summary of technician needs, skill requirements, industry assessment of community college programs, cooperative training programs, existing programs and curricula, instructor qualifications, and economy of scale in each field. (TR)

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Energy Technology Training Conference Proceedings

1976

Co-sponsored by:
U.S. Energy Research & Development Administration
American Association of Community and Junior Colleges

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We wish to express our sincere thanks to John R. Doggette, Oak Ridge Associated Universities, Oak Ridge, Tennessee, for his technical assistance and untiring logistical and administrative support that made the energy Technology Training Conference a reality; to Richard E. Wilson, Vice President for Programs, American Association of Community and Junior Colleges, who provided the coordination linkage with the college community; to Larry Stewart, Office of University Programs, ERDA, for his professional advice and assistance in the conference planning; to David B. Stovall, ERDA, for photographically recording the various conference activities; and to Patsy Nash, Business Education Department, DeKalb Community College, Atlanta, Georgia, and her students in the Future Secretaries Association, who served as receptionists and travel coordinators for all in attendance at the Conference.

Also, we appreciate the high-quality support received in the planning and implementation of the Energy Technology Workshops which were coordinated by the following host colleges:

Coal Mining
Wabash Valley College
Illinois Eastern Community Colleges
Mount Carmel, Illinois 62803

Petroleum
Lincoln Trail College
Illinois Eastern Community Colleges
Robinson, Illinois 62454

Nuclear
Roane State Community College
Harriman, Tennessee 37748

Solar
Scott Community College
Eastern Iowa Community Colleges District
Bettendorf, Iowa 52722

Our special thanks go to the 192 representatives from education, industry, labor and government, whose active participation throughout this Conference helped to assure its success. In the final analysis, it is education, industry, and labor, working cooperatively, that have the responsibility for result-oriented action leading to the continuation of quality technical education. We at the Federal level have the responsibility for being supportive to their efforts, and we accept this challenge.

J. Faherty Casey
Conference Coordinator
Division of Labor Relations
ERDA

October 26, 1976

Dear Conferees:

I am delighted to welcome you to the ERDA/AACJC Energy Technology Training Conference. I firmly believe that ERDA must develop policies and working relationships which will enable all elements of the academic community to make a maximum contribution to the national energy research and development program. This conference can be an important milestone in this effort.

Assuring an adequate supply of technical manpower to support our research and development needs, as well as the needs of broad scale commercialization of energy technologies, will require efforts which far exceed ERDA's limited resources. It is clear to all of us in ERDA that we must work closely with our sister Federal agencies and state and local counterparts. Most importantly, we must have a strong and effective partnership with education, industry, and labor if we are to accomplish our energy goals.

The role of the 2-year college as a primary producer of technical skills in the local community makes it a vital partner in this joint venture. During the 2½ days of the conference, you will have an opportunity to explore means by which we may better work together to build a technical education base focused on the energy challenge. The broad experience and varied perspectives of the group make it ideally suited to the task. I assure you that serious consideration will be given to conference findings and recommendations as we develop ERDA's manpower policy and strategy.

Sincerely,

Robert C. Seamans, Jr.
Administrator

Introduction

The Energy Technology Training Conference was sponsored by the U.S. Energy Research and Development Administration (ERDA) and the American Association of Community and Junior Colleges (AACJC) in Atlanta, Georgia, on October 27-29, 1976. A total of 192 Conference participants gathered to discuss and attempt to resolve issues surrounding energy-related occupational training programs which were in planning stages or being conducted by colleges.[1] Attendees were selected and invited to participate based on their prior experiences or interests in energy-related technician education. Colleges from 41 states sent a total of 111 representatives. In addition, there were 33 attendees from industry and professional associations, 9 representatives from state higher education organizations, 6 university attendees, 3 representatives from organized labor, and 30 representatives from 9 Federal agencies with human resource development mandates.

Conference activities centered on four energy-related technology workshops which were conducted concurrently and coordinated by the following host colleges:

Coal Mining
Wabash Valley College
Illinois Eastern Community Colleges
Mount Carmel, Illinois 62803

Petroleum
Lincoln Trail College
Illinois Eastern Community Colleges
Robinson, Illinois 62454

Nuclear
Roane State Community College
Harriman, Tennessee 37748

Solar
Scott Community College
Eastern Iowa Community Colleges
District
Bettendorf, Iowa 52722

The workshops' deliberations spanned 2½ days. In addition, two evening panels were held covering the technical training concerns of Federal agencies and state boards of education.

The Conference objective and specific goals were formulated in advance to provide a common basis for discussion on each issue of concern to instructors, program administrators and industrial employers of the graduating students. Colleges with both existing and planned energy technology training programs were encouraged to discuss issues from their different perspectives. In addition, workshop agendas recognized the special training characteristics of each technology.

Conference participants were interested in using what was learned to improve existing energy-related technology programs or to aid in planning new programs. Practical problems of program development and implementation were stressed throughout the meeting. Emphasis was also placed on means for better utilizing existing resources of education, industry, and government.

All Conference presentations and discussions were electronically recorded. Over 1,700 pages of transcript form the basis for this report which highlights Conference findings and recommendations within a framework of Conference goals. Oak Ridge Associated Universities, a prime contractor to ERDA, compiled and edited the Conference transcript and assumes full responsibility for the extensive synthesis necessary to structure the proceedings. The energy workshop segments of this report are divided into summaries of findings, recommendations and dialogue. The letter of invitation and a listing of Conference attendees are included in Appendices A and B.

The Conference co-sponsors believe the stated objective was successfully accomplished (Appendix C). The evaluation of the Conference, based on post-Conference questionnaires, indicates that 92% of the 125 respondents rated the Conference as "good" to "excellent."

H. T. Herrick, Director
Division of Labor Relations
Energy Research and Development Administration

[1] The term "college," throughout this report, denotes community/junior colleges and technical/vocational institutes.

Opening Remarks

James R. O'Gwin, Assistant Director for Contractor Manpower, Division of Labor Relations, U.S. Energy Research and Development Administration (ERDA), opened the Conference, welcomed all attendees, and outlined the Conference objective and goals. Presentations were made by Raymond G. Romatowski, Norman Seltzer and Richard E. Wilson, which set the tenor for the working conference.

ERDA Assistant Administrator for Administration, Raymond G. Romatowski, indicated that the energy problem, simply put, is that the United States relies most on its least plentiful domestic energy resources and relies least on the most plentiful. The most plentiful energy resources in the United States are coal and uranium, but many technological obstacles must be overcome before their use can be increased substantially.

There are ten major programmatic areas in ERDA. Nine of these are oriented towards increasing the supply of energy and have established immediate, mid-term and long-term goals. The tenth area is oriented toward decreasing the demand for energy and has established a series of conservation and end-use efficiency programs.

Two ERDA documents, Volume I —*The Plan*, and Volume II—*Program Implementation of a National Plan for Energy Research, Development and Demonstration: Creating Choices for the Future*, 1976, explain the program plan of each energy alternative.

ERDA is not a single actor in this drama. It operates within a governmental context and within the context of the national energy policy. There is some truth to the comments, depending on how they are phrased, that this Nation does not have a national energy policy.

Energy technologies are ultimately implemented in the private sector and, hence, are subject to all the vicissitudes that govern economic life in the private market place. ERDA is mindful of the fact that when we undertake a technological initiative and a R&D program is implemented, it should be in partnership with those entrepreneurs, those organizations, those companies and those associations which, in fact, will have to put the technology in place and, quite frankly, profit out of doing so.

ERDA has to learn to work not only with other Federal agencies but also with regional, state, and local organizations such as those represented at this Conference. There is a growing awareness that energy problems have a tremendous social, political and economic impact at the local, state and regional levels of society. Federal agencies are learning that they cannot do the job alone, that they must do it in concert with state and local political jurisdictions.

The importance of initiating a result-oriented dialogue among representatives of those institutions which have the responsibility to supply and/or apply skilled manpower to technology areas where critical shortages may develop was stressed as a primary purpose for this Conference.

Norman Seltzer, Chief, Manpower Assessment Office, Office of University Programs, provided a summary of ERDA's manpower data collection system.

ERDA's responsibility for helping to assure an adequate supply of energy manpower includes, but is not limited to, collection, analysis and dissemination of necessary manpower demand and supply data related to energy research, development and demonstration (RD&D) programs. ERDA undertakes near- and long-term manpower planning studies which supplement and complement data collected by other public agencies and private organizations.

ERDA is presently completing the first phase of a 5-year energy manpower plan. Part of this plan involves providing community colleges with the best information available concerning the knowledge and skill requirements of energy and energy-related technicians. ERDA recognizes the need to provide data in a timely manner so they will be useful for curriculum planning and career guidance.

ERDA has developed a broad, three-faceted program: (1) a comprehensive energy manpower information system, including baseline data on energy RD&D manpower and maintenance of these data; (2) a series of methodologies in which the data can be used to assess manpower demand and supply; and (3) recurring, in-depth assessments to provide timely and relevant information as an aid for program decisions.

The comprehensive manpower information system will be used to gather new data when needed to supplement existing information. When the system is fully implemented, ERDA will have the basis for near- and mid-term assessments of the demand and supply for skilled craftsmen, technicians, and professionals. Separate data will be available on technicians required by each energy program area, i.e., petroleum, coal mining, nuclear, solar, and conservation.

In addition, ERDA plans to sponsor follow-up studies on experience in the labor market of graduates of energy technology programs. Finally, ERDA will undertake a variety of special studies, when appropriate, to meet particular needs.

AACJC Vice President for Programs, Richard E. Wilson, explained the joint planning activities between ERDA and AACJC which resulted in the Conference.

AACJC was pleased that ERDA has stressed quality training in all its discussions. Both organizations recognize that there is a shortage of trained technicians and that colleges are capable of preparing persons with the needed skills.

Federal agencies have traditionally sponsored university programs which provided people with doctoral degrees and other advanced degrees in the scientific and engineering fields. Technicians have always been in demand but it has only been within the last few years that shortages of trained technicians have received attention.

Not all personnel in Federal agencies or in private industry have confidence in the ability of community colleges to conduct energy-related technician training. The Division of Labor Relations, ERDA, and the coordinating colleges, have taken considerable time and effort to invite participants interested in improving the quality of education being received by energy technology graduates. It is going to be up to the participants at this Conference and the colleges represented to convince the skeptics that there is a shortage of qualified, energy-related technicians and that community and junior colleges and technical institutes are capable of preparing individuals to meet this shortage.

Objective

To assist in meeting the manpower requirements for implementing the Nation's energy research, development and demonstration program by establishing a working relationship among education, industry, labor and Government which is supportive of quality technical education in energy-related occupational fields.

Goals

Identify:

- Projected Technical Manpower Needs and Skill Mix Requirements
- Potential Obstacles to Developing an Adequate Technical Education Base

Stimulate:

- Education, Industry, and Labor Cooperation in Technical Program Development
- Federal Interagency Coordination and Cooperation

Highlights of workshops and panels are summarized by Conference goals as follows:

GOAL 1: IDENTIFY PROJECTED TECHNICAL MANPOWER NEEDS AND SKILL MIX REQUIREMENTS

Findings

- National data rarely can be disaggregated to reflect local employment demand.
- Proprietary concerns of industrial employers restrict access to employment trend data.

Economy of size becomes even more critical in this context and a fear of proliferation of competing technology programs sometimes inhibits the free exchange of information, staff and other mutual self-help activities which otherwise exist in college communities. Here again, fragmentation of labor markets and regional interests, by the more narrow service districts and political subdivisions which normally define clientele of each college, undermines.

- Limited exchange of energy-related skill supply data is evident among colleges.
- Impending Federal regulations, incentives, and programs create uncertainty.
- Intake and placement policies of colleges restrict opportunities to meet regional or national needs.
- Dramatic fluctuations of national energy scenarios limit confidence in extrapolations of manpower needs.
- Uniform definition of energy occupational categories is lacking.
- Lack of timely information regarding the siting of major energy demonstration projects and extraction activities limits long-range manpower planning.
- Coordination of energy manpower needs at state or regional levels is deficient.

Skill Mix

- Inadequate linkage exists between college and employer during program development phase.
- Conflict exists between specific skill needs as perceived by local employers and need to develop standardized curricula.
- Controversy exists regarding the extent to which existing programs can be upgraded or modified to meet emerging needs and the extent to which new programs are required (i.e., modify existing Heating, Ventilation and Air Conditioning program curricula to incorporate skill training needs for solar energy or initiate a new program).
- Ambiguities in concepts and terminology limit common understanding of skill content.
- Budgetary restraints prevent task analysis by colleges at industrial sites.
- Student cooperative programs between education and industry aid in validation of curricula.
- Importance of non-technical skills (e.g., communication, human relations, etc.) should be maintained in all technology areas.
- Quality of skill components within program curricula is influenced by relevance and recency of faculty industrial experience.
- Lack of universally-accepted competency standards exists within the various technologies.

Recommendations

- Commonly accepted definitions and categories of energy-related occupations and skills must be developed which will permit collection and aggregation of timely and meaningful manpower supply and demand data. Education and industry should take the initiative to establish mechanisms to collect manpower data at state and/or regional levels which are adequate for local program planning needs. Functions of the group effort should include:

  Developing uniform definitions

  Assuring confidentiality of industrial proprietary information

  Promoting information exchange

  Avoiding duplication of effort

  Identifying resource requirements for data collection and dissemination

- At the national level, Federal programmatic mandates must be clearly defined and communicated so that manpower impacts can be traced to the local communities. Particular attention should be directed toward:

  Assessing human resource implications of programs and policies

  Assuring Federal assistance priorities reflect support needs of state and regional coordinating groups

GOAL 2: IDENTIFY POTENTIAL OBSTACLES TO DEVELOPING AN ADEQUATE TECHNICAL EDUCATION BASE

Findings

- High technology programs require costly equipment and facilities.
- Lack of an authoritative source of information regarding national energy objectives, which may affect competing college priorities, is evident.
- Colleges fail to identify common objectives or to share resources and information.
- College compensation structures often will not accommodate salaries commanded by potential instructors with industrial experience.
- Fears that competing programs will saturate placement opportunities limit cooperative arrangements among colleges.
- Federal funds tend to favor start-up support rather than strengthening existing programs.
- College mandates to train within local or intrastate boundaries are inconsistent with program development needs.

Recommendations

Barriers which prevent colleges from reaching their full potential in contributing to the development of human resource needs must not be understated. High unit costs caused by a combination of equipment and facility requirements and the need to compete with industrial salaries to attract experienced instructional staff frequently mean technology programs lose out to less expensive educational programs.

technology program needs. To many, the policy and direction of the national energy program are unclear and inadequate to assess manpower impacts or to rationalize local program needs. Resolution of these factors obviously exceeds the capability of individual participants and highlights the need for concerted action by the concerned parties.

It is recommended that a high level study panel consisting of representatives from Government, education, industry and labor be established as the first step in a collaborative effort to overcome these very real obstacles. Several agencies, including the Employment and Training Administration, DOL; the Office of Education, HEW; and the National Science Foundation, should have an interest and might be called on to support such a study. However, ERDA,[2] because of its energy mandate, should assume lead responsibility for the panel.

GOAL 3: STIMULATE EDUCATION, INDUSTRY AND LABOR COOPERATION IN TECHNICAL PROGRAM DEVELOPMENT

Findings

- Industrial cooperation, while universally accepted, is unnecessarily limited.

  Work experience activities exclude opportunities for faculty participation.

  Industry sponsorship of employee participation in the development and operation of college programs is generally limited to off-duty time.

- Participation by organized labor is frequently overlooked.
- Eighty-one percent of industrial and organized labor representatives indicated continual dialogue is essential to better cooperation.
- Industrial employers do not universally accept the premise that colleges produce quality candidates.
- Conference was first opportunity in petroleum and solar fields for education program development dialogue among industry, education, organized labor, and Federal and state agency representatives.
- No forum at state, regional or national level to facilitate cooperation.

Recommendations

It was widely accepted by Conference participants that cooperation among education, industry and labor is desirable. This cooperation is generally accomplished through local advisory groups which include industrial representatives from firms with employment opportunities for college graduates. Labor participation is not as widespread. Internal initiatives should be taken by the colleges to broaden representation and to better define the scope and objectives of local groups. The effectiveness of individual advisory bodies for each energy area could be improved through formal affiliations at the state and/or regional level.

The objectives of the advisory groups at the state and/or regional level should include, but not be limited to:

- development of increased opportunity for faculty industrial work experience activities.
- development of a flexible mechanism which will encourage increased industrial and labor participation in education program development and implementation.
- assessing impact of state and/or regional energy-related industrial activities upon development of quality, technical educational programs.

It is also recommended that working conferences similar to this be held at least biennially for each energy area at the national level. AACJC, ERDA, and/or other appropriate Government agencies should serve as primary sponsors for such meetings.

GOAL 4: STIMULATE FEDERAL INTERAGENCY COORDINATION AND COOPERATION

Findings

- Limited interagency coordination.
- No national mechanism for comprehensive planning.
- All Federal agencies have a stake in manpower, from the perspective of either user or producer.
- Most agencies are mandated to support human resource development; however, with exception of Department of Labor and Department of Health, Education and Welfare, preponderance of support directed toward university level.
- Federal priorities favor "start-up" support as opposed to strengthening existing programs.
- Dissemination and replication of curricula, instructional materials and program methodologies are inadequate.
- Limited sharing of resources among agencies with common educational support objectives.

Recommendations

- Interagency memoranda of understanding should be drawn up which set forth cooperative agreements among the various agencies having authority to assure an adequate supply of manpower skills to carry out the Nation's Energy Program. Areas of cooperation should include:

  Collaborating in the program and budgeting process.

  Sharing resources in data collection, education and training activities.

  Establishing an interagency coordinating (or management) mechanism to assure an ongoing effort is maintained in the field of energy manpower.

- Each agency should review its existing programs and reallocate funds to reflect priorities of energy education and training needs at the less-than-baccalaureate level.
- ERDA should accept the responsibility of establishing and maintaining an energy-related technology information clearinghouse.

[2] With the pending legislation to create the Department of Energy, recommendations with regard to the Energy Research and Development Administration (ERDA) infer ERDA or its successor.

Dr. Eric H. Willis, Assistant Administrator for Institutional Relations, ERDA, was the featured speaker at the Conference luncheon and shared the following comments:

"I am not sure whether or not we should have armed guards posted at the doors to prevent any unauthorized access and have the transactions of the meeting covered by the espionage laws—we seem to be about to discuss one of the best kept secrets from the American public—the energy problem. The simple facts have been there for quite some time. Consider for a moment what has happened in the period from 1960 to 1975. Over that 15-year period the United States' total production of petroleum was 46 billion barrels, while total discoveries of new sources of petroleum amounted to 22 billion barrels. That indicates a net loss of 24 billion barrels despite the discovery of the 10.8 billion barrels in Prudhoe Bay fields in 1968.

The picture for natural gas production and discoveries is similar. Over the same 15-year period, American production was 271 trillion cubic feet, while total discoveries were 177 trillion cubic feet, producing a net loss in gas reserves of 94 trillion cubic feet. The Prudhoe Bay discovery of 35.1 trillion cubic feet provides a slightly less disturbing picture.

For the first six months of 1976, United States oil demand was slightly less than 17 million barrels a day, up 2.3 percent from a year ago. Imports increased 14.5 percent to supply 6.6 million barrels a day, about 38.6 percent of United States consumption. For one week last March, we imported more petroleum products than we produced.

Largest shares of crude oil imports in the first quarter this year came from Saudi Arabia (22 percent); Nigeria (17 percent); Indonesia (10 percent); Canada (8.6 percent); and Libya (also 8.6 percent). That is a striking change in the pattern of imports from 1970, when 51 percent of our crude imports came from Canada and 20 percent from Venezuela.

Meanwhile, 1974 was the most successful year for successful well completions—and the lowest for the total amount of oil discovered, meaning that the costs are being driven remorselessly up to extract what oil we have.

Now there need be no problem in the 80's if we are prepared to do one simple thing—import more foreign oil, for after all, there is plenty of it there. The gas lines are fading into the distance. Some indeed advocate this. But what are the consequences? They impinge in the broadest sense on our national security, by which I mean our way of life and the supply of jobs, goods and services to sustain that way of life. This year, our balance of payments will probably have a $3 billion deficit—this would have been far greater but for arms sales, particularly to our Mid-East oil suppliers. In June alone, a 34 percent increase in oil imports was the key factor in the creation of that month's deficit. If we move into a heavy deficit situation, the dollar will follow the British pound and suffer further devaluation. This will cause OPEC to exert pressure for a further rise in oil prices to maintain constant purchasing power, so our oil and other imports could cost more. Further, we would have to export more goods, including wheat, to pay for the imports causing further inflationary pressures at home—we are familiar with the consequences of that malaise.

So what do we do about it for the 1980's? And in parenthesis one can't consider the 80's without considering the next 25 years, because the lead-time of some technologies are in that order. The answer is a complex mix of technological innovation, capital investment, public and private, and socio-economic and environmental concerns.

Technology

ERDA has reviewed all the major technologies in view and has assigned the following priorities to their development in terms of impact and attainability:

In the near-term, that is until 1985, the highest priorities for energy supply enhancement go to direct uses of coal in industry and utilities, to fission reactors, and to enhanced recovery of oil and gas.

Highest priorities for reducing demand go to conservation in buildings and consumer products; to more efficient use of energy in industry and transportation; and to the conversion of waste materials to energy. In order to reduce demands for conventional fuels and to reduce pollution.

In the mid-term, meaning from 1985 to the year 2000, highest priorities for energy supply go to producing gaseous and liquid fuels from coal, and to extracting oil from shale. On the demand side during the mid-term, we must rely on the conservation habits and energy-conserving investments which we hope already will have been established during the near-term.

We are also looking to other underused technologies for the mid-term, including geothermal energy, solar heating and cooling, and waste heat utilization; and to technologies supporting intensive electrification, like more efficient electric conversion, more efficient electric power transmission and distribution, and electric transport and energy storage. In the Texas-Louisiana area there is an interesting possibility of exploiting the so-called geopressured zones which are not water deposits thought to contain saturated amounts of natural gas. The amount of gas, according to a U.S.G.S. survey could be twice as much as our now known natural gas reserves, or 500 Quads. There are great uncertainties about the extractability of this resource and efforts are now under way in this area to determine whether there is truly a ball game or not. You will notice I have not mentioned the breeder reactor, fusion energy, or solar electric, which all fall in the post year 2000 period for commercial application.

What kind of power plant or other installations might be required by the year 2000 to house these technologies? ERDA projects the numbers of major facilities that might be required by the year 2000 in a variety of scenarios. They include:

Approximately 600 nuclear power plants of 1,000 megawatts each (we had 37 in 1975);

Up to 100 geothermal power plants of 1,000 megawatts each (we have only one today, of half that capacity);

Up to 100 solar electric power plants of 1,000 megawatts each (we have none today);

600 fossil-fuel power plants of 1,000 megawatts each (we had 400 in 1975);

Up to 140 coal liquefaction and gasification plants producing the equivalent of 50,000 barrels of oil per day (we have none today);

Up to 80 shale oil plants producing 50,000 barrels per day (we have none today);

2,000 coal mines each producing the equivalent of one million tons per year (we had 640 in 1975);

15 million buildings heated and cooled by solar energy (today the number is negligible);

Sufficient facilities to produce 10 million to 20 million electric automobiles (today the number in operation is negligible).

In addition, there would be requirements for supporting facilities, the mills, the transportation, and the delivery systems for energy produced by these technologies. These are formidable numbers, but they are calculated on the ambitious assumption the country can reduce the expected growth in demand by 25 percent, this mainly by major changes in end-use systems.

Capital Requirements

So much for the technologies themselves. What are the demands on the capital market to fund these investments?

The nuclear power plants and the coal-fired power plants, the plants producing liquid and gaseous synthetic fuels, and the oil shale plants would cost between $500 million and $1 billion each in today's dollars. For the 600 to 1,400 plants in these categories, the costs, therefor, could range up to $1,500 billion in the next quarter century. That would average as much as $60 billion per year, but of course larger amounts would be required in later years, and probably less would be needed in the next few years.

For the near-term, from 1976 to 1985, ERDA has estimated capital requirements for the major sectors of the energy industry in five scenarios.

In the oil sector, capital requirements are estimated to be between $74 billion and $103 billion.

In the oil shale sector, up to $7 billion may be required.

In the gas sector, the range of estimates is from $81 billion to $95 billion.

In coal, from $17 billion to $37 billion; this latter estimate in case of a moratorium on nuclear plants.

Synthetic fuels from coal would require up to $18 billion.

Solar, up to $26 billion.

The nuclear fuel cycle, as low as $6 billion, but probably $19 billion to $23 billion.

For electric utilities, the range is from $325 billion up to $340 billion.

We need not go into the specific mixes of technologies for each of the five scenarios. Suffice it to say here that capital requirements for these near-term scenarios fall within the relatively narrow range of $532 billion to $586 billion. These estimates include capital requirements for energy work in progress during the 1976-85 time frame, for the plants to be completed later than that. The estimates are stated in terms of constant 1974 dollars, so the total number of current dollars which will be involved will be larger.

In short, this country will need a variety of technologies and tremendous capital investments—more than half a trillion dollars by 1985—to move away from its risky 75 percent reliance on oil and gas.

Now what is the Government's role in all this? Why an ERDA? We are a free enterprise society and thus by definition, the role of the private sector will be paramount. It has inherent flexibility to act; it controls the preponderant share of new investment funds; and it possesses the necessary managerial capabilities for carrying out most of the research, development and demonstration and virtually all of the technology introduction. As you well know, market forces as they are perceived by decision-makers in the private sector will determine the optimum mix of alternative energy technologies to replace today's undue reliance on petroleum

and natural gas.

Unfortunately, we have these conflicting time and risk constraints.

The first is the response time of the free market to respond to a market demand in terms of acceptable carrying time before cash flow commences, and also, I might add, commensurate with acceptable risk.

The second is the response time of technological development from basic concept to economic commercial application. As we have seen, in the case of the breeder reactor, fusion and solar electric energy, this could be 25 years away even if all goes according to plan. That means about 25 years to cash flow with uncertain risks technically, as well as social acceptance. What prudent company is going to invest in that prospectus? Clearly this requires public sector involvement.

The third is the time constant of our national problem, which is literally growing worse by the day.

The National Energy Plan clearly has to accommodate these three time and risk constraints. It is an important theme of the National Plan for Energy RD and D that the private sector and market forces are the most efficient means of achieving the Nation's energy goals. It should be axiomatic therefore, that the Plan must not be Government-imposed, but probably Government-led. ERDA is taking considerable pains to interface with societal America, by public meetings, programmatic thrusts, and its organizational structure. My own office was created to further the partnership of state and local governments, industry and university with ERDA.

Socio-Economic and Environment

In the last two years the average annual use of energy declined 2.5 percent while gross national product dropped at an average of 1.9 percent annual rate. During those two years, unemployment rose by over three and one-half million persons. Obviously, the goal of full employment depends to some extent on an adequate energy supply. Linked to employment is the manpower availability problem associated with the development of new technologies. We have to have the right mix of manpower from Ph.D's to welders. We must avoid the boom and bust in manpower that ended the aerospace era.

Western states, which stand to be affected most by resource development, are understandably concerned about the social affects of boom towns on their communities. Boom towns bring trailer camps, without roads, sewers and schools. The result can be illiteracy, child abuse and a high incidence of violent crimes. The solution to the energy problem in the 80's has to take this situation into account.

Likewise land despoliation, such as that caused by surface [strip] mining, must be made good. Environmental concerns of states such as Wyoming are perfectly legitimate. They deserve the close attention of industry and Federal Government alike. In other areas, such as our nuclear energy development, linkages between energy use and a clean environment are complex and difficult to quantify, but there is no mistaking their existence. We're in trouble, of course, if clean environment means, 'If you can measure it, it's bad.' There must be reasonable regulations which recognize the benefits of energy use when they clearly outweigh the costs. These regulations must be held fixed for reasonable periods of time, so that planners in both private and public sectors can efficiently adjust to them. Even then, there will be effects on costs, but at least these can be minimized. We must even be sure to remove the perception of an environmental problem where none exists, because perception in the minds of the uninformed public becomes the reality.

So what is the bottom line for energy in the 80's? In summary one might say:

1) That vigorous conservation and energy efficiency measures should be a way of life.

2) We have to push coal, fission reactors and enhanced recovery of oil and gas in the near-term.

3) There will be significant capital investment.

4) There will be socio-economic and environmental concerns to be addressed which will have significant impact on our society.

5) The problem is a National one—a public and private sector partnership.

The quotation from Omar Khayyam seems appropriate.

'The moving finger writes, and having writ moves on, nor all thy piety nor wit shall lure it back to cancel half a line, nor all thy tears wash out a word of it.'

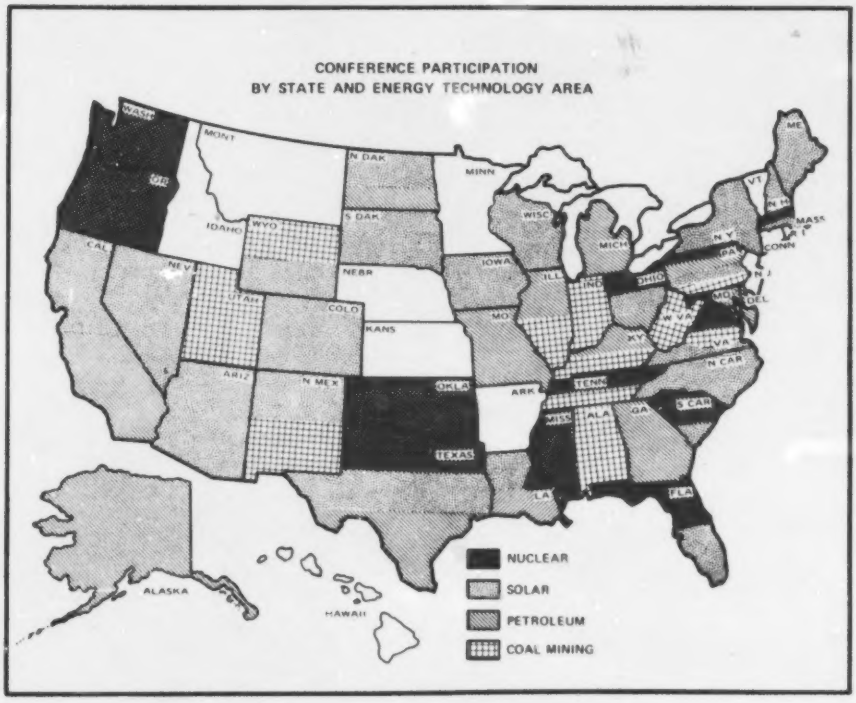
The message is clear—and so must be our determination. We can't undo the past, but we can help shape the future."

Technology Workshops

Community, junior, and technical colleges are a vital part of the Nation's educational system, playing a significant role in meeting present and future demands for skilled workers in energy-related fields. Colleges involved in the continuing education of local residents recognized that the development of energy industries will result in new jobs, both regional and national. At the same time, colleges realize that they must carefully assess occupational needs in energy areas before initiating new programs.

The American Association of Community and Junior Colleges and the Energy Research and Development Administration realize that many colleges had established energy-related occupational training programs prior to and as a result of the energy crisis. To determine how many colleges offered programs, and to identify what types of assistance they needed, a state-of-the-art study was conducted.

This study, the first of its kind, identified the extent to which colleges are involved. It documented existing and planned energy programs; confirmed a need for support and guidance in establishing curricula; and examined the relationships between colleges and energy industries. The results of the survey substantiated the need for the Conference and were the basis on which the technology workshops were planned. The details of the survey results are contained in the report, "Energy-Related Technology Programs in Community and Junior Colleges: An Analysis of Existing and Planned Programs," (Appendix F).



Coal Mining

Introduction

The Coal-Mining Technology Workshop drew representation from both underground and surface mining interests. Twenty-eight educators were present from colleges and state associations representing 19 existing coal-mining programs. Participants from two colleges were considering new programs. The mining industry was represented by six participants with extensive training experience. Two representatives of the U.S. Mining Enforcement and Safety Administration (MESA) were also in attendance.

The coal-mining workshop was unique in that the training is heavily influenced by industry participation and involvement in the programs conducted by education institutions. Industry representatives exhibited the understanding and first-person candor of having worked in the development and daily operation of many of the programs.

The education representatives emphasized the need to improve their operating programs as opposed to establishing new ones. The educators were experienced in working with industry advisory committees, in soliciting support from organized labor, and in training to meet employers' skill requirements.

IDENTIFICATION OF PROJECTED MANPOWER NEEDS AND SKILL MIX REQUIREMENTS

Findings

- The aggregate demand for coal miners is a function of tonnage of coal to be mined, location of new mines, relative difficulty of extraction at different sites, mix of underground and surface mining, and the projection of output per miner.

- The Energy Research and Development Administration (ERDA) does not have legislative responsibility for coal extraction; therefore, it has not commissioned manpower supply and demand studies.

- Colleges obtain short- and mid-term regional manpower demand data through surveys they conduct of local coal companies.

- Demand data for supervisory and maintenance personnel are particularly relevant for program development planning by colleges.

There is common recognition that national manpower data for the coal-mining industry have limited value to colleges operating programs. The existing studies and projections of national need are suspect because of the undefined role that coal will play in the national energy plan. The variables underlying manpower projections are continuously being altered and will be changed again with the adoption of a national energy policy.

Regional data are desired by the colleges to justify program size, course offerings, and extraordinary expenses. Both industry and college participants emphasized that single company tonnage estimates and manpower projections are not made available to competing companies. Colleges are able to conduct local studies only if they can assure employers of the confidentiality of individual company responses.

- The U.S. Mining Enforcement and Safety Administration (MESA) mandatory safety standards and the United Mine Workers Association (UMWA) contract of 1974 provide the foundation of required skills for coal miners.

- Coal-mining programs conducted by community colleges provide skills beyond entry-level requirements to enable the graduates to qualify for supervisory or certified positions as rapidly as conditions allow.

- Training programs and their respective instructional objectives differ because of influence by local industry and advisory committees and limited access to program information from other educational institutions.

Reports from all sections of the country, except the sparsely populated states, indicate an abundance of applicants for coal-mining jobs. The survival of each college's program is based solely on providing better skilled applicants than are available elsewhere. Whereas placement in nuclear and petroleum programs is frequently national, in coal mining the emphasis is on providing the students with the skills required for local employment.

The education institutions use a variety of training approaches to meet the skill requirements of local companies. Colleges follow no standard curriculum for coal mining. The college and the local advisory committee agree on various ways to provide the needed skills. For example, a particular need for surface mine supervisors resulted in a cooperative associate-degree program; a company preparing to open a surface

Coordinator: John Gwaltney, Wabash Valley College, Mount Carmel, Illinois. *Moderator*: Chuck Harrison, AMAX Coal Company, Indianapolis, Indiana. *Recorder*: Gordon Ward, Northern Wyoming Community College, Sheridan, Wyoming.

mine provided scholarships to students to attend a one-year equipment maintenance program.

• Coal-mining instructional materials are scarce. Materials developed by one company are seldom shared with other companies. Education institutions are beginning to share instructional materials with each other on an *ad hoc* basis.

• Cooperative programs provide opportunities to develop job skills and to experience the work environment. Such programs require agreements among colleges, mining companies, and organized labor.

• College programs are judged by potential employers on the basis of several factors:

  Mining experience of the instructors.

  Strength of the program's advisory committee.

  Compatibility of the curriculum to actual human resource requirements of the company.

  Appropriateness of the equipment and facilities used in training.

• This workshop was the only energy area that emphasized the need to provide continuing education courses to those presently employed in order to develop their potential beyond the specific skills needed for entry-level employment. It is recognized by industry that poor supervisory ability and the lack of employee satisfaction are problems needing systematic manpower development planning.

Recommendations

• A national task force comprised of representatives from industry, organized labor, and education is needed to:

  Systematically collect and disseminate instructional materials on all aspects of coal mining.

  Periodically meet to share program findings.

  Assist the industry in improving safety standards and increasing productivity.

• Colleges should work with the MESA Academy officials to explore opportunities for complementary training activities such as those needed to improve health and safety courses and to upgrade instructors.

• When a national policy on energy is formulated, with attention to future coal extraction standards, a national coal-mining manpower study should be conducted which would provide data on regional manpower requirements; separately assess demand for surface and underground miners; and anlyze demand in specific job categories where certification or specific skills are required.

• Studies conducted by education institutions, using information from local companies and organized labor, should be continued and recognized as probably the best available planning data.

• A number of programs exist in almost all coal-mining regions and primary attention should be directed toward strengthening the existing programs, rather than creating duplicate programs.

IDENTIFICATION OF OBSTACLES TO DEVELOPING AN ADEQUATE TECHNICAL EDUCATION BASE

Findings

• A strong advisory committee with significant industrial representation is precondition to a successful coal-mining program.

• State funding of personnel, equipment and materials for comprehensive coal-mining programs is usually inadequate, especially in sparsely populated states experiencing rapid expansion of coal-mining activities.

• Reluctance by coal companies to collaborate on manpower development activities requires frequent duplication of efforts that limit the accessibility of successful training materials and approaches.

• Competition among education institutions without adequate coordination may jeopardize quality training.

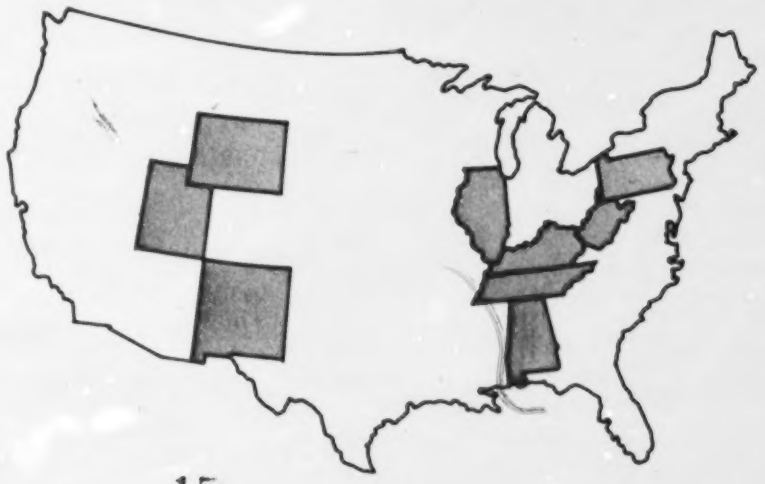
Recommendations

• Federal funding is needed to assist cooperative efforts among education institutions. Development and exchange of instructional material, opportunities for instructor upgrading, equipment acquisition and start-up funding in underpopulated areas are primary needs.

• Federal agencies should be aware of and work with the coordinated manpower development activities of all education institutions.

• State agencies should assist colleges in minimizing dysfunctional competition and encourage interstate cooperative agreements.

• Coal companies should continue to integrate education institution training into their total manpower development programs. The companies should support education institutions by providing advisory services, equipment and financial resources.



Community College Participation by State:
Coal-Mining Workshop

DIALOGUE SUMMARY

The opening session was led by Murray Rottenberg of MESA. Both the present and pending MESA training requirements concerning health and safety regulations were discussed. Rottenberg stated that improving mining health and safety conditions is MESA's responsibility, and that MESA needs to determine whether college graduates exhibit superior health and safety practices in mining. While MESA recognizes that present and pending standards might be construed as negatively affecting production, the intention is to improve the worker's environmental conditions. Several of the industry and college participants who were scheduled to testify at congressional hearings on pending mining regulations had varying opinions regarding the possible effects of the new standards on training.

Technician Needs

Bernard Friedman, consultant to ERDA for fossil energy, discussed the work he had done in assessing the status of mining manpower.

- While ERDA is not mandated with responsibility for mining of coal, it recognizes that raw material is needed in order for the Nation to attain its energy goals. ERDA has reviewed existing studies and projections, but has not conducted or commissioned any supply and demand studies on coal-related manpower.

Ron Sanderson, Secretary for the Illinois Basin Coal-Mining Council, an informal group of industry, government, labor and education interested in coal mining and its related manpower concerns, described the Council's experience in surveying industries' manpower requirements. He stated that such informal groups offer the best opportunity to acquire manpower demand information.

- Individual coal companies are reluctant to release information on future tonnage estimates or manpower requirements. To acquire cooperation, Wabash Valley College, Mount Carmel, Illinois, and the Council jointly conduct a confidential yearly survey of the major coal-producing companies in the three-state Illinois Basin. Only the aggregate information is made available to other companies and interested parties.
- In the Illinois Basin the projected manpower requirements for additional personnel by 1985 are 12,000 underground and 4,800 in surface mining.

Ted Renner, Principal Investigator/Coordinator, Old West Regional Commission, Bismarck, North Dakota, presented the findings of a study conducted by the North Dakota Board of Vocational Education to determine manpower needs and job skills required by the coal-mining industry in the state.

- Twenty percent of the country's estimated coal resources are in North Dakota, a state with about 0.3 percent of the total U.S. population.
- The North Dakota State Board of Vocational Education has been funded for 2 years by the Old West Regional Commission to determine training needed by North Dakota residents to be competitive for employment opportunities in the new and emerging occupations within the fossil energy conversion industries. Project goals were to:

  develop survey methods to establish and identify manpower needs,

  develop a task analysis system as a data base for the types of skills and competencies that would be required, and

  conduct a demonstration training program for industry review.

- Industry raised three areas of concern to be resolved before company participation could be achieved.

  Proprietary employment data might not be handled confidentially.

  Industry needed assurance that participation did not imply commitment to hire all trainees.

  Industry did not want its projections and future plans misinterpreted as fixed project plans.

- Difficulties regarding company participation were resolved and valuable data were obtained from the developed survey methodology. At the state level it is possible to identify needs for new programs, and requirements to strengthen existing programs. A program to develop career opportunity packages for local residents has also been established.

Skill Requirements

Rod Linder, Division Chairman, presented the skill requirements for underground mining that are addressed by Wabash Valley College in its training programs.

- The United Mine Workers' contract of 1974 was the first official recognition that a new miner should have some basic job-related training.
- No provision by contract presently exists for new inexperienced miners to demonstrate that they have acquired a level of knowledge or skills. The guidelines for training cover safety but do not recognize other inseparable areas of coal-mining production.

• A student or inexperienced underground miner should develop knowledge and skills related to mining law and regulations, accident prevention and safety, rescue operations, determination of coal mine atmosphere and ventilation, operation and maintenance of mining equipment, and roof and rib control.

Jim Phipps of Indiana Vocational Technical College, Tere Haute, Indiana, identified the skill areas in which instruction should be provided to the inexperienced surface miner.

The skill areas are accident prevention and safety, physical geology, maps and surveying, soils management, coal sampling, operation and maintenance of surface-mining equipment, transmission system, blasting and explosives, and electrical circuits and systems.

Manpower Development in Coal Mining

Myles Altimus, Director of Manpower, Peabody Coal Company, St. Louis, Missouri, emphasized the need for cooperation from all parties involved in coal mining if industry-wide manpower development efforts are to be effective.

• Manpower development is a very important but little understood subsystem in an organization. The successful utilization and development of human resources are as essential as the effective use of physicial materials, equipment, facilities, or plans for mineral extraction.

• Occupational titles and descriptions today have very little similarity to the titles and job descriptions of 5 years ago. Skill requirements and level of comprehension needed for the same job are far more complex today.

• Development of mining manpower cannot be accomplished without proper collaboration and coordination. Strategies for manpower development must focus on the whole organization and its environment in order to bring about change.

• The education strategy in the coal industry at this time is to sequentially match assistance from the public education, state and Federal agencies with industrial needs. This should be done without interfering with individual career goals or relationships with the employer. Compatibility with the coal industry's objectives is of the utmost importance.

• Anxiety over legislated requirements, contractual commitments and the economic situations frequently has caused communications among the groups within the mining industry to be counterproductive. For manpower strategies to succeed, they must permit persons and organizations to perceive the relationship between interpersonal competence and intraorganizational effectiveness.

Ken Moody, United States Steel Corporation, Pittsburgh, Pennsylvania, discussed possible reasons for underground mining production's decreasing from 15.4 tons per man shift in 1968 to an estimated current 9 tons per shift.

• Management has not been sufficiently "pro active" to anticipate changes in the social systems within the industry.

• The average age of coal miners has decreased from over 50 to the mid-30's in the last 2 years—completely altering the age and experience of the work force. The present employees are socially and geographically mobile and have different expectations than previous generations of coal miners.

• The industry has reached a technology plateau.

• Additional safety restrictions are being applied.

• Moody recommends the creation of a national mining management institute. Its goals would be to increase the industry's productivity to 1968 levels and to improve industry's safety record. The institute could assist in improving management training throughout the industry and function as a link between the industry and the national community, as well as between the industry and educational resources.

Industry Assessment of Community College Programs

Charles Harrison, AMAX Coal Company, Indianapolis, Indiana, discussed his philosophy for evaluating education programs in coal mining.

• The three most important elements in the evaluation of any educational program are:

relevance of program curricula to industry needs,

the qualification of the instructional staff, and

the adequacy of facilities and equipment.

• Mining curriculum should be aimed toward the eventual placement of the student. A cut-and-paste curriculum will not do. Courses should be developed with the assistance of an industrial advisory committee.

Best instructors are those with recent mining experience.

• Carryover instructors teaching trade-related courses should be re-educated toward mining in areas such as mine electronics and mechanical operation.

• Without MESA or state certification, an instructor cannot legally qualify students who perform acceptably in training.

• The facilities and equipment used to instruct miners are very costly. An auto mechanics course does not substitute for a heavy diesel mechanics course in mine equipment maintenance.

• An education institution should benefit the entire industry not merely a single company or economic benefactor.

• Students are attracted when they see that former graduates get good jobs.

All quality programs in coal mining have an applicant waiting list.

Bob McKeand, Assistant Director of the $20 million MESA Academy at Beckley, West Virginia, explained the Academy's programs and suggested ways that the Academy could join with education and industry to make the mining industry safer and healthier through the process of training and education.

- The first thrust of the MESA Academy, the sixth academy in the United States, is to train MESA mine inspectors in courses lasting from 12 to 36 weeks. The Academy has three departments: (1) the resident department, which conducts the training for new inspectors; (2) the seminar department, which is responsible for upgrading courses for existing inspectors; and (3) the continuing education department, which handles non-resident instruction, i.e., correspondence courses and programmed instruction.
- The Academy facilities and instruction are designed for hands-on training. The content of courses being offered could be of valuable assistance in developing needed instructional materials for college-conducted programs. The Academy is available to assist education institutions in building health and safety content into their curricula.
- The Academy is not considered to be in competition with colleges. The focus of the Academy is health and safety, with no direct interest in extraction or production skills. The Academy would like to complement and supplement training programs within education institutions.

Cooperative Training Programs

Revonda Williams, Assistant to the President and Director of Mining Technology Program, Mountain Empire Community College, Big Stone Gap, Virginia, described the College's co-op mining technology program which is supported by the local coal industry and mining advisory committee.

- As a "community" college, Mountain Empire responded to a company's request for training assistance. The program uses retired mining personnel from the United Mine Workers Association, the state and MESA as instructors.
- Students alternate each quarter between instruction on campus and work experience in the mine. When in the mine the students receive apprentice wages; however, they are not paid when on campus.
- A training agreement, which prohibits employment of the student prior to program completion, is signed by the student, the college and the company. All parties have been satisfied with this arrangement. Students are required to maintain a C average and, at the request of the companies, grades reflect the importance of regular class attendance.

An industry representative emphasized the point that the primary cost of a student co-op is borne by the company, and while there is definite benefit to all parties, the college and students must continually demonstrate the value of the program to industry.

George Kyle, Project Director, Mining Technology Cooperative, described the Madisonville Community College, Madisonville, Kentucky, cooperative program which is designed to train "face bosses." The program operates on an alternate semester basis and requires 2½ years to complete the association degree curricula.

- The student must be productive during the three co-op semesters spent underground. The college, the students, the employer and the local union, have a training agreement that requires the student to complete his education, prior to full-time employment—although it is, in essence only a moral agreement.
- The graduates are certified with 2 years of underground experience by State Department of Mines, plus they have an additional year of actual underground experience. When a student graduates, he has the required 3 years to be certified as an assistant mine foreman.
- The graduates have acquired mining capability and gained experience in seeking solutions to problems which limit production. Also, as underground face bosses, they are able to translate their understanding of human relations and needs into supervisory practices.
- The program is backed by an "activist" advisory committee composed of industry representatives, state officials, MESA staff, and college faculty. The function of the committee is to determine industry needs, evaluate ongoing programs, evaluate curriculum and to effectively guide the education institution in providing properly trained personnel.
- The program has full-time college staff, plus evening class instruction by local miners. The nearby vocational school facilities and instructors are used for certain evening courses. The students receive a good cross-exchange of instructors and equipment.

Coal-Mining Programs and Curriculum

Duane Letcher, Assistant Professor, explained the efforts of the Mining Extension Service of West Virginia University.

- The objectives of the program are: (1) to serve the miners by providing opportunities for educational and industrial advancement; (2) to serve the state by placing skillful workers in the mines; (3) to serve the industry by providing a well-trained work force; and (4) to stimulate and encourage miner training. The service has eight instructors who teach miners employed by 50 different coal companies.
- It is frequently found that the only criteria to evaluate effectiveness of a training program are through comparison of accident records. There is a serious lack of coordination, communication, and cooperation in the total aspect of coal-miner training and education.
- Coal companies with excellent training materials hesitate to share because of the competitive nature of the industry.
- Experience at West Virginia University corroborates the opinions of other spokespersons from education and industry that a national center to collect and disseminate instructional materials is needed.

Michael Bishara, Chairman, Engineering Division, Southwest Virginia Community College, Richlands, Virginia, discussed the philosophy behind Southwest Virginia's coal-mining program.

- The core-plus-option approach has been adopted to prepare students for production and supervision within coal mines, while allowing a limited number to be trained as engineering aides. There is a need to give the student a vocational option within coal-mining training between abstract thinking and manipulative skills. Education is designed to improve overall competence of the person in a specified direction beyond the job now being held.

• Southwest Virginia recognizes that dissatisfaction in industry, and among students, exists with traditional course work such as English, mathematics, communication and government. The value of such course content is lost because of ineffective, non-applied delivery at earlier stages of education. Courses are needed, however, to prepare face foremen to communicate effectively. Mathematics can and should be applied to mining problems. Human relations in the mining industry should be based on the principles of basic psychology.

• The college has the dual responsibility of providing skilled workers for industry while aiding students to fulfill their individual educational objectives.

Ed Hayduk of Pennsylvania State University discussed another successful training program, the 6-month mine-maintenance program: which has been conducted for the past 13 years by the Continuing Education Service at the University.

• Fifteen classes have been conducted. Originally, the class lasted 44 weeks (1,540 contact hours), but has gradually been reduced to two 23-week programs—805 contact hours. The students receive no college credit from the University. The program is funded by Comprehensive Employment and Training Act (CETA) prime sponsors and has 60 trainees per class, screened by Pennsylvania Employment Security and selected by the instructors.

• The basics of the program are engineering drawings, welding, mechanics, hydraulics, and electronics. The program has remained dynamic and has met technological advances in mine maintenance within the coal industry.

Instructor Qualifications

Ted Cross, Director, Career Studies, Casper College, in Wyoming, explained instructor qualification from his perspective of running a one-year program entitled Maintenance For Surface Coal Mines. Casper College is located in an impacted area of small population and large growth rate.

• All students in the program are on scholarships provided by a company preparing to open mines. The program is designed to provide basic skills in mechanics, welding and electricity. Instructor qualifications which were discussed included:

willingness to work with students in skills-development,

practical experience in the skill areas, and comprehension and commitment to health and safety.

Because of salary restrictions, Casper College cannot compete with industry for experienced miner-instructors, but the college accepts the responsibility for training its instructors.

• The program forms the first of 4 years of training for the student with the other three to be acquired on the job while moving from helper to craftsman. The "specialized-generalist" leaves Casper with the conclusion that specific training has only begun.

• In Wyoming, funding is difficult to obtain, especially since companies opening mines have not yet had to pay taxes. Programs like Casper's require commitment and initiative to overcome inadequate resources. Funding is needed from Federal sources to acquire qualified instructors and to conduct upgrading programs for instructors on changing industrial equipment. Too frequently, Federal funding is for new programs rather than for strengthening the strapped existing programs that were among the first to be innovative.

Economy of Scale

John Gwaltney, President, Wabash Valley College, Mount Carmel, Illinois, explained the necessity for total institutional commitment prior to implementation of high cost technology programs.

• The first priority for the program is competent instruction. Local funding is allocated to staff and curriculum first, and funds for equipment and buildings are second priority.

• The technology programs which will last and be successful must be relatively large and have acquired a reputation for quality training. Mining, like most training and educational fields, is becoming increasingly specialized. A one-man department cannot cover all areas. At Wabash Valley there are 12 full-time instructors with mining experience, all of whom earn over $22,000 a year.

• Quality mining programs need expensive equipment and must continually produce qualified candidates in order to maintain acceptable unit costs. The program is expensive and usually carries a heavier burden of accountability in the community.

• The coal-mining technology program has become a primary thrust of the college. Program objective is quality instruction for a large number of beginning students and on-site short courses to employed miners.

Gordon Ward, President of Sheridan College, Sheridan, Wyoming, reaffirmed the total commitment needed to conduct comprehensive coal-mining training and explained the College's program activities in rural Wyoming. Sheridan College has had to expand its training far beyond its campus to the rugged terrain, where major coal activities are under way.

• The program is mobile and operates within a 100-mile radius of the campus; thus, certain factors must be recognized: (1) cost is higher, (2) staffing is more difficult, and (3) program supervision requirements are extensive. There is a need to truly resolve problems, not to create a "gimmicky" program.

• The program has received over $400,000 from state, industry, and private contributions.

• Because the coal communities are in isolated areas, non-traditional training approaches are being applied. Mobile training vehicles are used to transport instruction to isolated communities. The college branch and service district concepts are being established.

• A strong 2-year associate degree program emphasizing the cooperative approach, the involvement of industry, and the coordinated recruitment, screening and placement of students is a clearly identified need.

Introduction

The nuclear workshop representation included 20 participants from 14 existing college programs and 9 participants from colleges considering the feasibility of initiating programs. Few of the participants from existing programs had ever met or were aware of the other programs. Seven industry speakers, a participant from the International Brotherhood of Electrical Workers, (IBEW), three participants from universities having nuclear expertise, and representatives from both ERDA and the Nuclear Regulatory Commission (NRC) gave presentations.

The participants from existing programs had encountered varying degrees of success in producing employable graduates. The delays in completing construction of nuclear power units with the utility industry had adversely affected the ability of the training programs to cooperate closely with local employers. Some of the existing college programs were in danger of being phased out, while new programs were being introduced in other regions with education-industry training cooperation. Few of the existing programs were graduating more than 10 students per year. Disagreement among speakers emerged on what skills should be taught and if programs should concentrate on developing individuals for entry-level positions or on upgrading technical skills of present employees.

The extraordinarily high cost of training technicians for the nuclear industry, specifically nuclear reactor operators, was emphasized. Certification requirements and other standards of qualification represented training consideration not prevalent in other energy-related programs.

IDENTIFICATION OF PROJECT MANPOWER NEEDS AND SKILL MIX REQUIREMENTS

Findings

- Economic conditions, construction delays, and Government policy decisions have decreased the industry growth rate and corresponding manpower requirements.

- Two regional supply and demand studies conducted by the Western and Southern Interstate Nuclear Boards project total demands at 10 to 15 percent per year in certain technician job clusters.

- The IBEW projects growth through the year 1990 for technicians within its bargaining units to increase 500 per year, of which approximately 300 will be reactor operators.

The two studies conducted for the Western and Southern Interstate Nuclear Boards and the projection of IBEW provide nuclear participants with the best manpower demand data of the four energy workshops. However, the colleges do not rely on the indicated expansion of nuclear technician positions for three reasons:

- Information on scheduled completion dates of major nuclear projects is continuously being altered,
- Program justification do not emphasize local demand by companies that will potentially hire graduates,
- Demand requirements for nuclear technicians do not specify what percentage of technicians will be required to be trained.

In the presentations on projected demand, a primary concern was how the colleges implement or maintain their programs within the constraints of industry demands. Obstacles to program development explain why colleges are not presently filling a larger percentage of the jobs in demand.

- The Nuclear Regulatory Commission (NRC) certification procedures require specific time and hands-on experience for power reactor training. In most cases, these requirements restrict colleges to pre-employment and reactor fundamentals training.
- No NRC educational standards presently exist for any other positions.
- The first programs were established with the expectation that power units soon to be constructed would create immediate demands. However, in many cases, due to construction delays, the demands have not materialized and the college programs are experiencing difficulty in graduate placement.
- The colleges which initiated the first programs have found it necessary to train persons for employment outside the college boundary. The local demand for skilled technicians has seldom been sufficient to absorb all graduates. A dilemma for some colleges is justifying a regional program when they are unable to enter cooperative relationships with the local nuclear companies.
- The most recent nuclear programs have been able to foster a training relationship with local companies or utilities prior to making the necessary financial

Coordinator: Carroll Marsalis, Roane State Community College, Harriman, Tennessee. *Recorder*: Chris Keim, Roane State Community College, Harriman, Tennessee. *Moderator*: Peter Chatton, Roane State Community College, Harriman, Tennessee.

commitments. The advisory committee is local and the skills training to be provided will be for specific company needs.

- Community colleges with strong programs are providing graduates with the skills desired by employers that frequently provide work experiences during training.
- Differing opinions existed on whether it is appropriate for colleges to attempt to educate or train technicians for nuclear power reactor employment.
- Utilities differ on whether the reduced cost to the utility for training is worth the risk of reactor "downtime" which could be caused by human error from inadequate outside training.
- Industry spokespersons all emphasized that applicants for nuclear employment from colleges need to be the graduates who demonstrate a competence in mathematics and science.
- Participants from industry and organized labor favor establishing a prerequisite that a company-education partnership be formed in the planning stage of a program to identify skill requirements and training techniques. Without prior agreements to favor college graduates, they cannot necessarily expect to gain employment.
- Educational materials for the industry are scarce or out of date. Regulations and reports on technological advancement are difficult to translate into training materials.
- The Technical Education Research Center, Waco, Texas, is developing instructional modules for use by community colleges in the training of nuclear plant operators.
- Colleges were not aware of other nuclear programs and had not shared program curriculum.
- Nuclear training programs normally have only one or two instructors because of the expense and small student enrollment. To maintain quality training it is necessary for the participating companies to assist the colleges in their instruction and to provide pre-employment training experiences.

Recommendations

- An association of education and industry persons involved in nuclear technician training should be established to:

  identify, collect and disseminate instructional materials on all aspects of nuclear technology training for industry,

  promote information exchange and minimize duplication of effort among interested parties, and

  identify resource requirements for manpower data collection and dissemination requirements.

- Surplus nuclear equipment from ERDA contractor system should be made more easily accessible to colleges.
- Opportunities for college instructors to upgrade their knowledge should be made available by the nuclear industry and Federal Government.

IDENTIFICATION OF POTENTIAL OBSTACLES TO DEVELOPING AN ADEQUATE TECHNICAL EDUCATION BASE

Findings

- The primary obstacle to developing quality nuclear training within a national base of colleges is industry commitment. Companies are seldom passive in their support of college nuclear programs; they are either actively involved throughout the training or prefer in-house training.

The representatives of existing nuclear technology programs identified their individual strengths in training and cooperation with local companies, their separate weaknesses in attracting students, in securing curriculum materials and in placing graduates. Only a few programs are achieving the triad of goals to: (1) maximize class size, (2) ensure close cooperation with local companies, and (3) place graduates with the local companies.

- Unless a college has the support of local companies to focus training requirements and to place graduates, it is difficult to maintain a viable program.
- A total commitment is needed by the college and the local community to develop and maintain a quality nuclear technician program. Facilities, equipment, instructional materials and instructor costs make nuclear technology

Community College Participation by State
Nuclear Workshop

programs among the most expensive. Unless a nuclear program has a full enrollment, the cost per student is prohibitive.

- Establishing a new program is predicated on an existing strong relationship with a nuclear company to train for identified occupations. The participants discouraged extensive program planning expenditures based on planned power unit construction projects within a college district.
- The delays in completing and manning local nuclear projects have created problems in coordinating timely placement of graduates. College programs are experiencing more difficulties in maintaining state support than are the other energy programs. Most of the graduates are being attracted outside the college district. State higher education boards increasingly are putting local placement restrictions on colleges which threaten the existence of programs having regional demand. Without industry and Federal Government support to endorse such training, individual programs may be phased out by the states.
- The attraction of students to 2-year associate degree nuclear programs is difficult at many colleges because of:

  lack of understanding of nuclear power,

  insufficient assurance of a job upon graduation,

  competing education alternatives for students with solid mathematics and science backgrounds.

- Recommendations on the necessary combination of pre-employment and specific nuclear skills that should be taught differ considerably among nuclear training experts.

Recommendations:

- A strong training commitment should exist between the college and local nuclear companies before a new program is established.
- The nuclear industry must identify the areas where the colleges should be providing skilled training and, as an industry, endorse and support such training.
- State higher education boards must provide support which will ensure that nuclear technician programs can produce quality graduates, while recognizing that not all students will be placed within the state.
- When a program cannot be maintained as a quality offering, it should be eliminated by the local college and the state.
- ERDA contractors, and public utilities with nuclear power units, should offer summer appointment opportunities to instructors of nuclear technology programs.
- ERDA should review its Surplus Nuclear Equipment Program to assure that its benefits are accessible to the post-secondary educational community below the baccalaureate degree level institutions.

DIALOGUE SUMMARY

Technician Needs

Wyatt Rogers, Executive Director, Western Interstate Nuclear Board (WINB), Lakewood, Colorado, discussed the supply and demand information that the organization had collected on nuclear related technicians.

WINB, organized in 1967 as an interstate compact agency of 12 western states, accepted manpower development as a key part of the overall energy question. It surveyed approximately 3,000 organizations in the 12 western states. The survey results are reported in the publication, *An Analysis of Nuclear Related Technician and Manpower in Western States*. This study projected a total nuclear-related technician employment of 22,800 by late 1977, a net growth of 6,000 since 1974. Total demand for new positions, plus replacements for attrition, is projected at 10 to 15 percent per year in certain technician job clusters.

- The survey defines a nuclear-related technician as any technician of any branch of nuclear or radiation technology requiring specialized skills and training below the baccalaureate level, an equivalent of about 2 years beyond high school. Forty-three technician and craft occupations are grouped into five broad occupational clusters.
- On the supply side, training programs are categorized as either institutional or employer related. Over the 3-year period (1975-1977) 7,225 graduates of 285 institutional programs are projected, and 1,497 graduates of 212 employer-operated training programs are projected.
- The projected average growth rate of technicians is 10 percent per year in the WINB area, a percentage similar to an earlier study conducted in 1973 by the Southern Interstate Nuclear Board. Larger increases in nuclear technicians

over the next several years might be expected in the South and West since they are growing faster than other parts of the Nation.

Mr. Paul Shoop, International Representative, International Brotherhood of Electrical Workers (IBEW), spoke on the union's interest in quality training and the projected need for technicians within organized nuclear utilities.

- IBEW represents the bargaining unit at 39 of the 64 power reactors now licensed to operate, and 110 of the 163 reactor units under construction or on order. IBEW does not supply personnel to the utility. The individual is hired by the utility and then becomes an IBEW member. The union bargains collectively for its members on wages, hours, and conditions of employment.
- At nuclear stations technical manpower is covered within four bargaining unit categories: (1) licensed operator; (2) instrument and control (I&C) technician; (3) chemistry-radiation protection (chem-rad) technician; and (4) quality assurance/quality control technician. Based on IBEW projections for the time period 1976 to 1990, 7,005 technicians will be added to nuclear stations: 4,122 licensed operators; 1,541 I&C technicians; and 1,342 chem-rad technicians. Average yearly additions for the period 1976-1990 will be 500: 294 licensed operators; 110 I&C technicians; and 96 chem-rad technicians.
- The quantity of persons per year requiring technical education is not high and, with a limited demand, not every school will be able to afford to maintain a quality nuclear technician program.
- The small group graduating from nuclear technician programs can seek employment opportunities from only a limited number of firms. Their greatest chance for success would be first to become employees of the utility and then enroll in a program. IBEW does not care how the selection is made as long as the programs are of high quality.
- For the past 5 years IBEW has been telling its I&C and chem-rad technicians to expect certification. A substantial number have reported they do not object to this requirement. Certification will bring about uniform educational and experience requirements for technicians which are, to some degree, lacking today. Continuing education is a way of life of licensed operators and IBEW does not oppose the initiation of formal continuing education programs for other technician categories.

Robert Neel, Nuclear Technology Department, Midland Technical Education Center, Columbia, South Carolina, provided projections on nuclear technician needs for South Carolina and expressed his reservations of the value of such numbers to an individual college program.

- In South Carolina there are at least 10 major nuclear facilities, including eight reactors. State projections for new nuclear personnel are for 105 people in 1977; 183 in 1978; 194 in 1979; 177 in 1980; and 167 in 1981.

Considering the need for both reactor personnel and fuel cycle personnel, the projected demand nationally would range from 1,000 to 1,200 persons a year. At most, 40 colleges with quality programs graduating from 25 to 30 persons per year per school would quickly fill the projected need.

Obstacles to Program Development

- According to Neel the obstacles to developing quality training programs in colleges stem from reasons other than a lack of demand:

companies prefer to train their own people, using colleges as a backup;

companies are very reluctant to fund any portion of college programs;

the nuclear industry is a region-wide and national industry, making it difficult for colleges, which seek support from their local communities and local industries, to develop programs on a proper scale;

a bright high school graduate earns no more in many nuclear industries after attending a nuclear program than if he immediately took a job;

top-ranked high school students are not strongly attracted to a 2-year nuclear program;

many nuclear employment opportunities require a person to be mobile.

Scott Fellows, Director, Applied Research and Technology, Southern Interstate Board (SINB), Atlanta, Georgia, also identified obstacles to the establishment of nuclear technology programs.

- A nuclear training program needs top management support, within both the education institution and the cooperating industries.
- Expensive laboratory facilities are required if a program is to be recognized by the industry as quality.
- Internal competition between

neighboring education institutions reduces overall program effectiveness.

- Instructors shall have nuclear industry experience and, thus, command salaries above that normally paid within the educational community.

Industry Assessment of Community College Programs

Clifford Beck, Assistant to the Director, Office of Nuclear Regulatory Research, explained the Nuclear Regulatory Commission's (NRC) interest in quality training.

- The major difference that sets the nuclear program distinctly apart from others is the need to carry an inventory of radioactive materials requiring control and regulation. Many training perspectives and insights are derived from this one fact.
- The epitome of the nuclear regulatory process is quality assurance—the provision for audit of all functions of significance for safety, integrity, and plant performance at each stage of development by persons independent of those who have the line responsibility for getting the job done. The internal check and balance system is required continuously for the operating personnel of the nuclear plant.
- There are no arbitrary conditions in the NRC standards on educational prerequisites that must be met for any position in the plant. The primary objective of training programs for nuclear technicians is to produce individuals with the ability to do the job at the required level. NRC recognizes the role formal college education plays in meeting this primary objective. The training program should be as similar as possible to the real job environment procedures.

Ken McCoy, Assistant Plant Supervisor, explained why utilities are reluctant to support education institutions in training technicians, and the conditions under which Mississippi Power and Light is working with Memphis State University.

- Mississippi Power needs only 150 people to operate its two power reactor units in Grand Gulf, which will produce sufficient power for the total state of Mississippi. In contrast, 3,500 people are constructing the plant over an 8- to 10-year period.
- Because of the extraordinary costs associated with downtime, a nuclear utility cannot afford the types of mistakes caused by poor analysis and human errors sometimes experienced in plant operations. Although it may be to the economic advantage of the utility to have other institutions training its people, the overriding concern is that the operating personnel be qualified.
- Presently, Memphis State University is offering Mississippi Power employees a reactor fundamentals course. The applicants were selected through a rigorous screening procedure and the program is being taught at the plant site. The program is a joint venture under a performance contract for the protection of both parties.
- The utility industry traditionally has not been able to attract highly trained people as qualified mechanics, electricians, and I&C technicians, although it never has had difficulty in recruiting engineers.
- Technicians, other than the reactor operators, need two types of training—pre-employment and job specific. In the training of I&C technicians, an area in which colleges are already involved, the student needs to have a good background in mathematics and science, and sufficient electronics to understand computers, micro-circuits and other instruments.

Denny Smith, Instructor, Terra Technical College, Fremont, Ohio, explained the linkage between the College's new nuclear technology program and the specific needs of the Davis Besse Nuclear Power Station being built by Toledo Edison.

- The objective of the program is to provide skilled, trained nuclear technicians to the utility company for job categories of operations personnel, support personnel and maintenance personnel, in order to minimize company time needed to train those individuals in the fundamentals of nuclear power. The students will be better assimilated into the utility training program by having attended the 2-year program.
- Toledo Edison has made instructors available for specialized areas of operation, equipment demonstration and, in addition, has made available its technical library for student use. The college has only one full-time instructor for the program, but has purchased simulator and modular instructional materials. The college is also assisting the utility in promoting the value of nuclear power in the community.

Paul Witherell, Dean of Instruction, Wentworth Institute, Boston, Massachusetts, informed the participants that the nuclear engineering program at the school is failing, even with industry support. Wentworth Institute, a private 2-year college, initiated its nuclear engineering technology program in 1961.

The program was accredited by the Engineers' Council for Professional Development in 1964.

- In spite of increasing total enrollment at Wentworth, the enrollment in nuclear engineering has dropped to an average of five students per class from the original 1963 graduating class of 26. Although local industrial and utility companies support the program, and 1975 graduates had a starting salary of $15,000 per year, the program is continuing to experience difficulty in attracting students. Local industries have purchased the "This Atomic World Program" for presentation in eastern Massachusetts high schools but it has not been successful in attracting students to Wentworth. With the present cost of approximately $25,000 per student, Wentworth is seriously considering discontinuing the program.
- In discussions of why colleges have difficulties in attracting students, it was hypothesized that students fear they do not have the abilities to handle the mathematics and physics required in a nuclear power program.
- At Wentworth, the entering student is required to have 4 years of high school mathematics, plus one year of chemistry and physics. Many students with this background, and an interest in the nuclear industry, initially enter a 4-year engineering program.

Skill Requirements

Gilbert Stone, Environmental Engineer, Division of Power Construction, Tennessee Valley Authority (TVA) informed the participants regarding the need for five types of nuclear technicians and how colleges can best serve TVA's needs.

- Based on TVA's licensing schedules, more than 1,000 nuclear technicians will be needed in the next 10 years for 18 units. TVA has recently started training in its $14 million nuclear training center located at Chattanooga, Tennessee. The objective of the center is to prepare nuclear power plant operators, instrument mechanics, chemical lab analysts, and eventually health physics technicians and engineering aides.
- TVA recognizes it can no longer get operators or instrument mechanics from the fossil side of the power program. The Plant Operator program is 24 months of combined classroom and on-the-job training. Of 30 trainees, 22 graduates are expected. Classes are staggered every 2 months. Student plant operators and instrument mechanics have been hired or upgraded without meeting requirements for college credit.
- TVA has turned to 2-year associate degree programs to acquire three categories of technicians: (1) chemical laboratory analysts, (2) health physics technicians, and (3) engineering aides. Recommendations made to colleges offering associate degree programs for these technicians categories are:

  curriculum must contain the fundamentals of mathematics and physics with the assurance that those who complete the program are competent;

  curriculum advisory committee must contain appropriately qualified and working members who can help update needed offerings;

  curriculum must keep abreast of changes in the nuclear power scene;

  effective counseling and proper placement are mandatory to ensure that students in the program have an aptitude in the nuclear field;

  off-campus laboratory exercises and field experiences should be provided;

  periodic feedback from graduates should be used as classroom input.

William Casto, a consultant reactor operator examiner for the Nuclear Regulatory Commission, provided his perspective on reviewing people who are no longer students and have become applicants for NRC reactor licenses. Applicants need more emphasis on basic nuclear theory. They are not taught enough to reason out problems or tell when an instrument is malfunctioning. Many of the mistakes that operators make result from their assumption that an instrument is malfunctioning when it starts reading outside its normal parameters.

- Applicants need a strong background in algebra and chemistry. Applicants must be able to read, write, and orally communicate correctly about the technical operating procedures of the utility.

Nuclear Technology Programs and Curriculum

Dan Hull, General Manager, Technical Education Research Center-Southwest (TERC), Waco, Texas, explained how this nonprofit organization, funded by the Office of Education, is developing instructional modules in nuclear technology. Two years ago TERC established a national steering committee for nuclear technician training which meets every 4 to 6 months. The committee identified five categories of nuclear

technicians for which TERC is developing curriculum modules: (1) nuclear plant operator, (2) radiation protection and rad-chemist, (3) nuclear instrumentation technician, (4) nuclear QA/QC technician, and (5) nuclear materials technician.

• Thirty-two courses are being developed, which total 232 modules. Each module is a separate document containing prerequisites, learning objectives, principles and procedures to fulfill objectives and a learning activity. Copies of the 94 modules for the nuclear reactor plant trainee are scheduled for completion by July 1977. TERC is using Texas State Technical Institute's two campuses at Harlingen, Texas, and Waco, Texas, and other colleges to pilot test the materials.

Fred Merklin, Assistant Director, Department of Nuclear Engineering, Kansas State University, Manhattan, Kansas, discussed the development of instructional materials for the nuclear fuel cell cycle.

• Instructors presenting courses in mining, purification and enrichment of nuclear fuel are impeded by the lack of available text materials and teaching aids. The practicing engineer may well ignore many important and current developments, in part caused by the lack of usable information on the nuclear fuel cycle.

• The purpose of Kansas State's project, supported by the National Science Foundation and ERDA, is to develop a series of educational modules for use in nuclear fuel cycle education. The modules will be designed for use in traditional classroom environment and/or self-paced modulized instructional packages.

• It would be a mistake for a college to undertake a new program specifically for training technicians in the nuclear fuel cycle. The program would be very expensive and would be in direct competition with the nuclear industry which has its own training programs. Education institutions should strive for excellence in the basic sciences: chemistry, biology, physics, and mathematics, as well as in communications skills.

Ed Dewell, a nuclear chemist for 24 years prior to becoming the instructor for the nuclear technology program for Central Virginia Community College, Lynchburg, Virginia, disagreed in part with Fred Merklin and recommended methods to improve instruction.

• The program at Central Virginia is based on the nuclear fuel cycle, and in its 3 years of existence has been well received by the employing industry.

• Colleges developing 2-year nuclear programs have been isolated. More opportunity for instructors to share experiences is needed. Teacher obsolescence will be a problem in the rapidly advancing field unless instructors receive structured opportunities to retrain. ERDA contractors and public utilities should offer summer appointments.

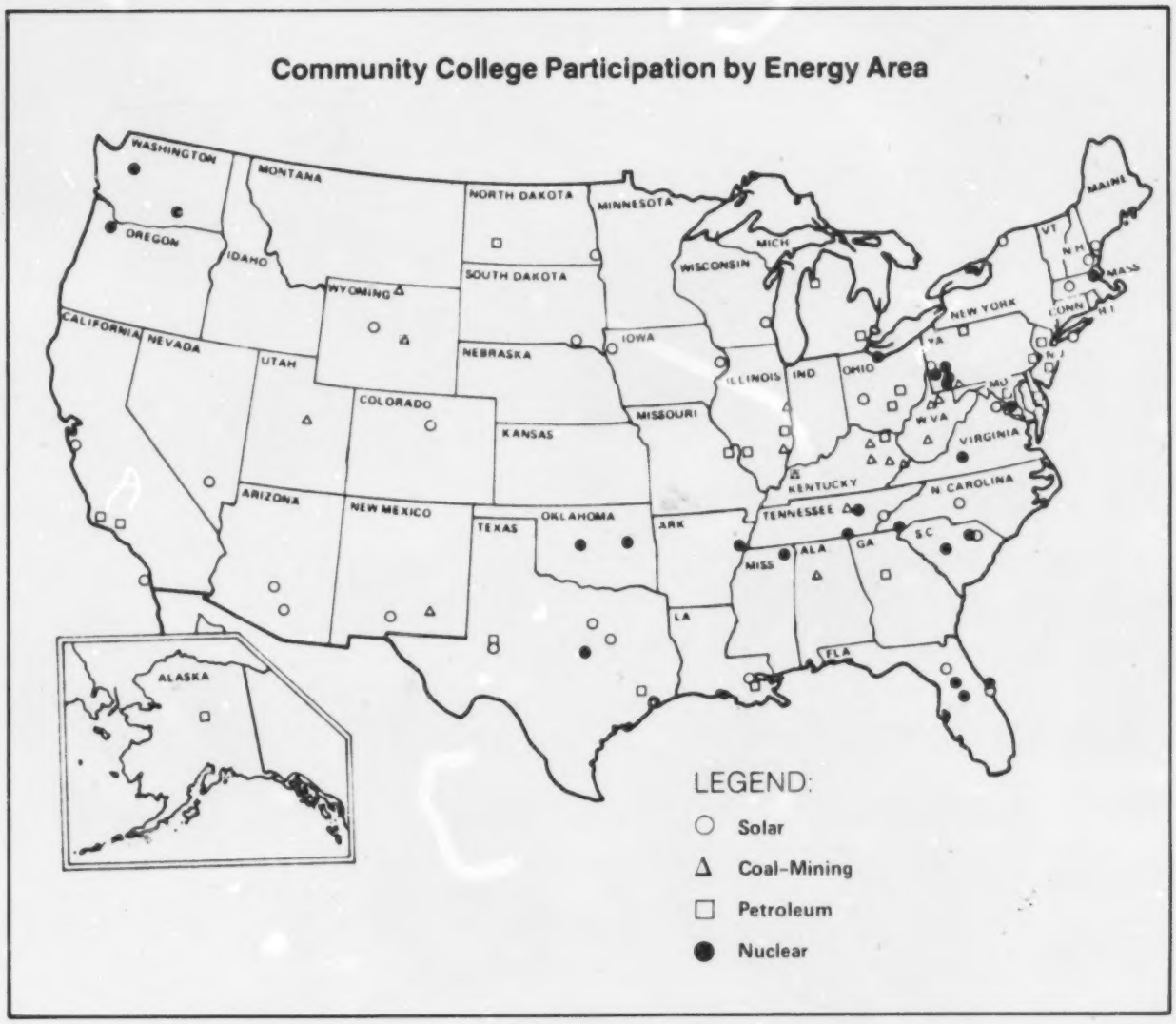
• Teaching materials for nuclear technicians are not available and it is frequently necessary for colleges to produce their own. Because of limited market, book publishers may not accept texts. Federal agencies should assist in getting the needed materials published.

• ERDA should develop a speakers' program which would make available competent technical personnel to visit campuses to share ideas and demonstrate ERDA's interest in quality technical training.

• ERDA should improve its procedure for distribution of surplus nuclear equipment by making the equipment availability lists easily accessible.

James Smathers, Chairman, Education Committee, The American Nuclear Society, discussed the relative advantages to accreditation of nuclear technology programs through the Engineering Council of Professional Development (ECPD).

• Potentially, ECPD accreditation could help the three principals: students, faculty, and prospective employers. Independent assessment with initial guidelines from the American Nuclear Society assures a student that the facilities, academic level, and breadth of the program are sound. The outside inspection team can support faculty requests for overcoming administrative obstacles to program improvement. The prospective employers are guaranteed that the graduate has a reasonable level of competency along stated guidelines. Essentially ECPD requires a 2-year technology program to be one-eighth nontechnical, one-eighth basic science, one-eighth mathematics, one-eighth optional and one-half technical courses.


Community College Participation by Energy Area
WASHINGTON
MONTANA
NORTH DAKOTA
MINNESOTA
OREGON
IDAHO
SOUTH DAKOTA
WISCONSIN
MICH
MAINE
VT
NH
MASS
WYOMING
NEW YORK
CONN
RI
CALIFORNIA
NEVADA
UTAH
NEBRASKA
IOWA
PA
NJ
ILLINOIS
IND
OHIO
MD
COLORADO
KANSAS
MISSOURI
W VA
VIRGINIA
KENTUCKY
N CAROLINA
ARIZONA
NEW MEXICO
TEXAS
OKLAHOMA
ARK
TENNESSEE
SC
MISS
ALA
GA
LA
FLA
ALASKA
LEGEND:
Solar
Coal-Mining
Petroleum
Nuclear

Introduction

The petroleum technology workshop was attended by 19 educators from 11 two-year colleges with existing petroleum technology programs, eight educators from seven colleges assessing whether their institution should offer a course of study, six representatives from the petroleum industry, and a participant from the Oil, Chemical and Atomic Workers Union. The petroleum workshop discussions emphasized existing college programs.

Motivated by the conference goals to gain insight concerning the projected demand for petroleum technology graduates and the qualifications or skills these graduates should possess, the workshop participants engaged in lengthy informative discussions.

IDENTIFICATION OF PROJECTED MANPOWER NEEDS AND SKILL MIX REQUIREMENTS

Findings:

- Available information from the petroleum industry for projecting the need for technicians is too imprecise to be used solely as the basis for establishing a need for a program.
- Many, if not all, petroleum technology programs were established to meet local demand for graduates in this field.
- Jobs filled by petroleum technology graduates are also filled by individuals trained in many other ways, e.g., on-the-job training, 4-year colleges, upgrading, etc.
- If petroleum technology graduates are to be preferred as quality job applicants for the petroleum industry, colleges will need to gain acceptance in the petroleum industry as valuable sources of manpower.
- Industrial unions like the Oil, Chemical and Atomic Workers (OCAW) organize workers by company or work unit. These unions do not exclude entrance on the basis of prerequisite skills, length of employment, etc.
- OCAW can assist colleges in formulating curriculum.
- Industry participates in co-ops and internship programs to appraise initiative, aggressiveness, ingenuity, and the ability of students to apply theoretical know-how. Cooperative summer work experience opportunities are a part of some programs but none offer alternate work/study opportunities throughout the academic year. Work experience programs tend to be national rather than local in placement.
- Petroleum technology programs, in general, have been started without the potential benefits of sharing what other colleges have done; programs range from those that provide an industry-wide overview to those that are very specific in skill development; and programs have varied instructional objectives to qualify graduates for employment in many sectors of the industry.
- Colleges located near off-shore oil drilling sites are uncertain whether they should start programs.
- Industry recruiters seek graduates from programs, considering the reputation of the program, the world-of-work qualifications of the instructor, the field and co-op experiences, and academic achievement of the student.
- Placement of graduates is accomplished informally through individual contacts between colleges and firms rather than through an agressive industry/recruitment program.
- Regional advisory committees to assist multiple education institutions may be more appropriate than local advisory boards for each college.

Recommendations

- Informal organizations composed of educators and training personnel from colleges, industry, and organized labor, should be created at the regional level to share projected manpower requirements information. Supply and demand data for petroleum technicians should be disaggregated by occupational category and geographical area for use in the planning or modification of operational training programs.
- State Boards of Education should assume the leadership required to initiate regional co-op agreements between colleges with petroleum technology programs and industry employers. Such agreements should include student work experience opportunities, summer industrial employment opportunities for college instructional staff, and loan of industrial personnel to provide technical assistance to colleges desiring to strengthen their program curriculum.
- Within each geographical region that has a viable petroleum industry, the respective State Boards of Education, working cooperatively, should endorse the establishment of a regional mechanism to foster the exchange of program information among colleges with existing and/or planned petroleum technology programs.

Moderator: Ed McKay, Lincoln Trail College, Robinson, Illinois. *Coordinator*: Dwight Link, Lincoln Trail College, Robinson, Illinois. *Recorder*: Edward O'Neal, Delgado Junior College, New Orleans, Louisiana.

IDENTIFICATION OF OBSTACLES TO DEVELOPING AN ADEQUATE TECHNICAL EDUCATION BASE

Findings:

The economy of scale necessary to operate a petroleum technology requires college commitment to its success, along with a stable student enrollment, to justify the expense of staff, equipment, and field experience requirements.

- The expenses of maintaining experienced staff and up-to-date equipment are much higher than those of general programs.
- The value of petroleum technology programs as a source of qualified individuals has not been recognized by the petroleum industry.
- The participation of company representatives in petroleum technology programs is primarily limited to memberships on an advisory board.

Recommendations:

- Advisory groups should be established on a regional level, with industrial and educational representation, to coordinate the exchange of information among colleges that conduct or plan to start a petroleum technology program and potential employers of program graduates. Information that should be shared includes:

  curriculum and course objectives,

  strategies that enable colleges to establish work experiences for students,

  methods to increase company participation in program design,

  effective graduate placement techniques, and

  methods of maintaining staff competence.

Perhaps the AACJC or the petroleum industry, through its professional association, should assume this role.

- The petroleum industry should develop, encourage and plan ways to aid college instructors in maintaining knowledge and application of new technology or practices in the industry. Providing information through local advisory committees is only one way.
- Federal agencies should consider providing colleges with support for curriculum development, instructor traineeships, and funds to effect information dissemination.

DIALOGUE SUMMARY

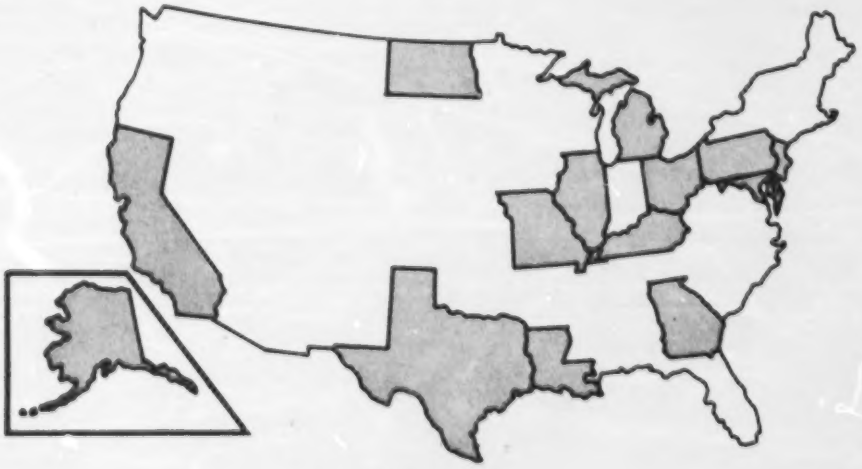
Technician Needs

Joshua Hill, Director of Petroleum Project, Texas Southern University in Houston, described university plans to initiate a 2-year program in September 1977. He explained the process that Texas Southern used in securing industry cooperation in the development of program curriculum based on local employer requirements.

- In a survey of Houston area oil and gas companies, 73 percent of the firms indicated a specific need for a technician with basic skills to assist geologists and engineers in drafting, map and profile preparation and basic collection of data. After examining the composite job description, 17 to 24 responding companies felt there was a need, but only 11 were willing to indicate they would hire such a person.
- Representatives of 12 companies reviewed the survey results, participated in field visitations and meetings, and assisted in finalizing the course content. On the strength of company support, more than on an estimate of numerical demand, the need for petroleum technicians was affirmed.

Wayne Horman, Education Coordinator, Oil, Chemical and Atomic Workers (OCAW), Denver, Colorado, explained that the Union cannot project its future growth.

- OCAW has a membership of 180,000 workers, of which 70,000 are employed in the oil industry. Sixty thousand of these work in refineries. As an indust ial union it attempts to organize all workers in an industrial firm.
- The union has no control over the labor supply. As such, except for local unions that have an input into industry training programs via the collective bargaining processes, the international union is not involved with skill training.
- OCAW is concerned with factors that affect the quality of work life. As a pioneer in improving health and safety conditions in the oil industry, the union supports the need for college courses in this area. Also, because of the increasing interest in union membership on the part of individuals in professional occupations, it is suggested that college Technology Programs should include quality course offerings in management and labor relations.



• Entry requirements for college programs often inhibit participation by the "working person" and should be reviewed to assure that such programs are, not only accessible, but appropriate in content and mode of delivery. Interested colleges are invited to contact Horman for further assistance with regard to the matter.

Skill Requirements

The business and industry representatives explained that individual recruiters have different sources for obtaining technical manpower; colleges represent only one source.

Since they represented different parts of the industry, the petroleum company spokespersons held differing views regarding the specific skills required of petroleum technicians. However, each speaker included as desirable attributes an ability to communicate a positive attitude toward improving skills, and positive human relations.

Knowledge of the objectives of the college's petroleum technology program helps the recruiter to evaluate a graduate's technical skills.

Lloyd Ramirez, Chief of Producing Operations, Shell Oil Company, New Orleans, Louisiana, offered his rationale in recruiting, and the reason for lack of emphasis on hiring college graduates.

• In Shell Oil less than one-third of the engineers have petroleum engineering degrees. Most have degrees in mechanical, chemical and civil engineering. Recruiting for engineers at the universities affects the recruiting of technicians in that 4-year people are hired as technicians.

• The technician staff at Shell represent the people who get things done in the field. They translate a lot of the engineering into what happens as far as operations and they assist the engineers. New hires entering the technician occupations go through field operations from 6 months to 4 years. As technicians they generally work under the tutelage of a person with specialized knowledge.

• Shell Oil looks for specific skills: initiative, aggressiveness and ingenuity. Through co-op programs and summer programs, Shell can observe each potential new hire, not just in terms of theoretical knowledge, but also how the skills are applied.

• The skills needed foremost are communication skills. Without the ability to communicate orally and in writing, a technician is of limited value. In mathematics, a solid background is required in basic algebra and trigonometry. A knowledge of computers and a broad understanding of economics is desirable. In specialized areas, hydraulics, construction welding, plans and drawings, and chemistry are important. Additional knowledge of petroleum geology, physics and petroleum nomenclature is valuable. Safety, efficiency, knowledge of regulations and contracts are topics with which the new technician will quickly become involved.

Industry Assessment of Community College Programs

Wells Rader, Manager, Houston Employment Center, Shell Oil Company, made a number of recommendations to improve industry-college recruitment and hiring practices.

• Students should realize that grades and other evaluations of their performance made by faculty weigh heavily in the recruiter's decision to make offers of employment. Students should be more concerned with employment opportunities than with the location of the job. The college should prepare for a visit from a recruiter by scheduling students and faculty for interviews before the recruiter arrives.

• The opportunity to observe the technical abilities of the prospective employee can best be accomplished through either an internship or a cooperative. After hiring, the company must assess the employee's skills and discuss his progress with him. The initial assessment should be the basis for a continuing employee development program.

Richard Moorehead, Employee Relations, Cities Service, Tulsa, Oklahoma, provided insight into how industries assess instructor qualifications and capabilities in highly technical area.

• Today's petroleum technology education is concerned with the practical application of engineering achievement with emphasis on the end product, rather than the conceptual process. Whereas the development of new methods is the mark of the engineer, effective use of such established methods is the mark of the technologist. The engineering technician is expected to implement what the engineer conceives.

• The 2-year program should be designed to teach the basic fundamentals of the operation of the petroleum industry, the "how to do it" end. A technology graduate should be capable of eventual independent action in the performance of technical activities and frequently become involved as coordinator or supervisor of other technical personnel. The successful student must be taught to assume responsibility of supervision, as well as the actual translation of ideas into practical use.

• The instructor must be a source of creditable information from which the graduates can walk away both satisfied and qualified. A good instructor is knowledgeable of both the work environment and the skill demands that program graduates will experience when employed as petroleum technicians.

• An instructor should have formalized methods of instruction: practical job experience in at least the basic areas of exploration, drilling, and production; communication skills; and belief in what is being taught in preparing the students for the future working world.

Petroleum Technology Curriculum

A series of presentations on existing petroleum technology programs suggested the diversity of instructional objectives found among colleges and career opportunities for graduates. The programs generally are planned through the cooperation of local advisory boards with minimal sharing of information among colleges having petroleum programs. Many presentations emphasized the need to design technology programs within state regulations to maximize funding possibilities. Two non-degreed programs for Comprehensive Employment and Training Act (CETA) clients were also discussed.

The Muskingum Area Technical College, Zanesville, Ohio

• The major instructional areas of the 2-year Petroleum Engineering Technology program are land acquisition and leasing, geology site preparation, drilling, cementing, augering and perforating, fracturing, completion and production, pipeline flow, refining and distribution. The program offers a full-time summer internship with emphasis on field experiences throughout the Appalachian Basin in which Muskingum is located.

• Entering students are made aware of three things:

petroleum technician graduates will probably start at the bottom,

job requirements are such that a high attrition exists,

safety must always be a chief concern.

• The program director recognizes that continued local placement depends on investment money for new exploration. Overall program success, however, is dependent on the willingness of the major petroleum companies to accept graduates.

Lincoln Trail College, Illinois Eastern Community Colleges, Robinson, Illinois

The college is located in the center of the largest single oil field in Illinois. Enrollment has grown in the 2-year petroleum technology program from 8 in 1970 to 100 in 1976.

• The program includes seven areas: drilling and exploration, production, refining, service companies, sales and supply companies, gas storage, and petro-chemical.

• Students are placed in summer internships throughout the nation. In Illinois, students must be paid at least the minimum wage to be called an intern, and to allow the college to collect under the top state funding priority. Interns are visited personally by an instructor and an assessment is made by telephone and correspondence with the student and the employer. During visits videotapes are also made for later classroom use.

Tanana Valley Community College, Alaska

Alaska will become the number-two producer of petroleum in the U.S. before 1980. The college has two programs: one in mining and petroleum technology and the other in petroleum technology; both have small enrollments. The extreme cold and perma-frost conditions within Alaska require specific skill development for in-state employment.

• Because of limited enrollment in petroleum technology, Tanana Valley Community College plans to modulize its four basic courses to provide a broad-base overview of petroleum technology. With small enrollment the program has only one instructor.

Delgado Junior College New Orleans, Louisiana

• The 2-year terminal non-transferable petroleum technology program is within the Engineering Technology Department. The program enrolls approximately 50 students, most of whom are part-time adult students, and the college has an average of 10 graduates per year.

• Delgado's objective is to prepare technicians to support engineers in drilling and production. The program emphasizes drilling and production skills for employment needs in Louisiana, which is the leading gas-producing and the second leading oil-producing state in the U.S.

Reynolds Electrical and Engineering Company (REECo), Las Vegas

REECo is a support contractor for ERDA at the Nevada Test Site (NTS), located approximately 65 miles northwest of Las Vegas, Nevada. The principal mission at NTS is underground nuclear testing.

As a prime contractor, REECo has actively participated in the Agency's Technology Training Program (TTP) which was established in 1975 to address two issues related to evolving energy technologies: (1) human resource development, and (2) technology transfer. The program concept involves maximum mobilization of local industrial and educational resources to train individuals for energy-related occupations at the technician, operative, and craft skill levels.

Through the joint efforts of Thompson Van Bebber Directional Drilling Services Company, the Clark County Community College, and the Las Vegas-Clark County Consortia—a prime sponsor under CETA– REECo coordinated the development of an intensive 6-month Directional Drilling Technician Training Program.

• Students receive classroom and on-the-job training in Bore Hole Survey Instruments, Survey Calculations, Vector Sheet Calculations, Proposal Development, Drilling Assemblies and Stabilization, Fire Prevention, and other Safety Aspects.

• Graduates are prepared to assume entry-level positions in offshore drilling and other operations where holes must be bored into the earth diagonally rather than vertically. Since the angles and directions for such drilling are determined by complex mathematical calculations, developing mathematical skills is given heavy emphasis in the program.

• An important feature of the program is that it is tailored to meet the individual needs of each trainee. This is quite different from lock-step programs where everyone is exposed to the same training experiences regardless of background and previous experience. Trainees' knowledge and skills are carefully assessed throughout the program. This competency-based approach is especially valuable when relatively expensive training is offered, and when the participants begin the program with widely varying skill levels.

• This pilot program for 10 trainees demonstrated the ability of ERDA contractors to effectively combine local industrial and educational resources to provide highly specialized skill training. The graduates were placed worldwide. REECo's goal is to disseminate instructional materials developed for this program to selected colleges throughout the Nation.

Hocking Technical College, Nelsonville, Ohio

The Hocking Technical College Oil Well Servicing and Maintenance Program trains head pumpers and tool dressers in a 12-week non-credit certificate course. It is funded by the Comprehensive Employment and Training Act and four classes are conducted per year.

• The program objective is to provide practical skill and related knowledge that will enable the successful participant to obtain employment as a head pumper, tool dresser, roughneck on the oil rig or related employment in the oil and gas industry.

• Graduates are hired by small drillers in Appalachia who cannot afford to operate their own training program.

Economy of Scale

From the presentations of the existing programs, the differing approaches to petroleum technology were demonstrated. The balance of the workshop evaluated the conditions needed for establishing and maintaining a program at a size and perspective appropriate for the sponsoring college.

Joe Piland, President, Lincoln Trail College, Robinson, Illinois, keynoted the discussion by raising those issues that his college faced in implementing and expanding its petroleum technology program:

• Education administrators too often evaluate a program on whether it is breaking even. If a program is not making its way, educators strive to save money or increase enrollment; if the program is above the break-even point, they tend to relax.

• Educators need to think of quality, along with cost effectiveness. Determining the number of students needed for a technology program depends on the program objectives.

• A college can offer a specific narrow approach or a core program with several options. Each additional option raises the dollar costs drastically.

• In a high technology program it is difficult to provide both the breadth of courses and the depth of specificity desired with a one- or two-person staff. Unless a course can be offered more than once a year, the cost of supplies and specialized equipment can be prohibitive. Having only one entry time for students tends to increase instructional costs and complicates the placement of graduates.

• Summer internships, in which faculty visit and evaluate the students, can only be effective if the placements are local or the number of students placed nationally is large enough to justify the costs of visiting.

• State legislatures are no longer providing increased funding. State boards of education less frequently are able to provide supplemental funding to support high cost technology programs.

• The hard reality is that high technology fields such as petroleum are difficult to make cost-effective with broad skill objectives unless the enrollment is large. A program with narrow specific objectives is usually economically and qualitatively feasible.

• Education will be served better by having a few excellent and cost-effective programs than by having many mediocre ones.

David Williams, Coordinator of Instructional Resources, Santa Barbara City College, in California, responded to Piland by adding two additional considerations in evaluating the economy of scale of high technology programs:

• The local advisory committee, which colleges are accustomed to working with is a thing of the past. What educators should be considering are regional committees in order to avoid duplication and competition with other education institutions, industry, and the Federal Government.

Santa Barbara City College operates on a 3-year initial program development budget and then a 3-year budget figure based on sustaining the program. It becomes a "go/no-go" operation at the end of 3 years if the college is to sustain the program.

• Every college must examine its institutional and funding commitment to high cost technology programs. Admittedly, there are budgetary constraints

and a limit that the system can tolerate, but that should be the searching question, not whether a program has 10 to 200 students.

Five community colleges from Pennsylvania, New Jersey, Maryland, and Delaware were interested in the effect on their institutions of pending off-shore oil exploration. None of the five colleges has petroleum technology programs and their concerns were on the economy of scale.

Charlotte Purnell, Dean, Delaware Technical and Community College, Georgetown, Delaware, stressed the importance for continued dialogue among representatives of education, industry and government to focus solely on the needs of colleges which are considering implementation of high cost, energy-related technology programs. She suggested that the agenda of a meeting, if convened to consider these needs, should address the following:

- What effects will off-shore drilling have on the small college in a rural area where industry is divided 50 percent in agribusiness and 35 percent in tourism?
- How many people will be required?
- Will it be a one-shot effort?
- Will the employees be brought in from the outside?
- Will additional upgrading and continuing education courses be required?
- Another concern to be answered in order to satisfy the local residents is whether offshore drilling is compatible with local environment needs.
- In colleges as in business, economics is the name of the game. A primary concern is duplication of programs by nearby institutions. A college cannot bring in staff or train people for jobs that do not exist.

Is it better to have a separate program in petroleum technology or a number of options within the existing framework of engineering technology?

Would it be better for an institution planning a program to have a contract with an institution that already has a petroleum technology program?

Would it be better to bring the staff in on a one-time, twice-a-week basis, rather than employ these people for something which may be a boon or a bust?

Are colleges going to price themselves out of business?

Is it going to be too expensive for colleges to do the job than by doing it in concert with the oil companies?

Introduction

The solar workshop is reported to be the first in-depth symposium on the emerging training requirements resulting from the rapidly expanding solar industry.

The 38 college participants were primarily instructors in Heating, Ventilating and Air-Conditioning (HVAC) or construction technology programs, with limited solar energy course offerings. They were interested in what should be done to develop the training capability required in solar energy.

Lacking an already established base of industry education training programs, the participants focused on what should be done to establish industry/education cooperation. With few exceptions the activities of colleges in implementing solar courses were individual efforts requiring a minimum of expenditures. Training courses described were those sponsored by companies and associations.

The workshop was also characterized by a concern to correctly promote solar energy and solar energy technology training. Industry representatives referenced the lessons learned when the heat pump was introduced before it was technologically sound, and before sufficient people were trained to service the units. Solar units must be economically attractive, properly and easily installed, and maintained, if solar technology is to have a large-scale impact on new housing starts.

IDENTIFICATION OF PROJECTED MANPOWER NEEDS AND SKILL MIX REQUIREMENTS

Findings

- Projections by industry and ERDA participants on the rapid advancement of solar installations, primarily solar water heaters in residential and commercial dwellings, indicate the need for an expanding well-trained work force.

While the projected growth of the industry is accepted by all participants, the skill qualifications of technicians were disputed because the demand for technicians is contingent on what skills will be required for different parts of the industry. One hypothesis is that the total demand will be met with minimum retraining of the existing heating, ventilation and air-conditioning work force. The opposing opinion is that a comprehensive associate degree program will be needed to fulfill the demand for troubleshooters for sophisticated solar systems.

- ERDA has contracted a study to identify job categories in the solar sector and to acquire related supply and demand manpower data.
- The existing limited solar energy courses in colleges are of recent origin.
- Solar skill training programs are being conducted by private companies, labor unions, and professional associations.
- Participants agreed that technician training is needed. They did not agree on who should be trained, what should be taught, or the appropriate duration of training.

The Solar Energy Industry Association supports short courses of one to two weeks for Heating, Ventilation and Air-Conditioning (HVAC) technicians.

The National Training Fund for the Sheet Metal Industry believes that only three to six hours of training is necessary for a sheet metal worker to learn to install solar equipment.

The majority of college participants concurs that the feasible approach is to strengthen existing HVAC programs with solar course work.

- Some college participants advocated initiating advanced planning activities to prepare instructional programs for technicians to install and service future sophisticated systems and to support engineers and architects in solar research and design.

The workshop focused on future skills required to support technological advancement. Descriptions of the types of technicians needed and the skills required are largely dependent on the perspective of the speaker. Industry spokespersons desire a sufficient work force in place to properly install solar heating and cooling equipment, labor representatives want to guarantee that their membership will receive an appropriate share of the work, colleges want to acquire emi ence in solar technology. This lack of a common perspective is most noticeable in the solar workshop because training standards and relationships have not yet been established.

- The college participants advocate:

Improving existing heating, ventilation and air-conditioning (HVAC) programs.

Providing short courses for employed technicians and craftsmen.

These two strategies were supported by the industry representatives in attendance.

A small group of college representatives expressed the need to identify the skills used in the application of solar heating and cooling technology, particularly before it becomes more sophisticated in both commercial buildings and residential structures. If colleges provide future solar technicians they will need adequate lead time for curriculum planning and program implementation.

A number of company projects and solar research and demonstration activities were identified that could be used to support or supplement college offerings.

Moderator: O. C. (Buck) Burnell, Scott Community College, Bettendorf, Iowa. *Coordinator*: Robert Illingsworth, Scott Community College, Bettendorf, Iowa. *Recorder*: Paul Greene, Navarro College, Corsicana, Texas.

While a strong education/industry partnership is advocated, cooperative efforts exist at only a few locations. The demonstration solar residential building program, funded by ERDA and the Department of Housing and Urban Development (HUD), has projects in all regions and would be valuable for training experience. Companies offering in-house staff training may want to integrate their efforts with college courses.

• Requirements for instruction and equipment are less industry centered than in the other three energy technology areas.

HVAC instructors with a knowledge of and commitment to solar technology represent the primary source of future solar instructors.

• An education institution needs a complete solar system which would demonstrate all phases of operation, but the system does not have to be expensive.

• The Solar Energy Applications Laboratory, Colorado State University, has the most experience in developing instructional materials, although their uses are directed toward the needs of individual contractors.

Recommendations:

• Supply and demand manpower information for the solar sector must contain information on specific job categories by region in order to benefit any education institution planning a solar program.

• An association of persons interested in solar technology training should be established and meet periodically to disseminate systematically relevant materials.

• Most colleges interested in solar technology should consider supplementing their HVAC or building construction programs for training entry-level students and providing upgrading courses for employed technicians.

• Advisory boards comprised of potential employers of graduates are essential to each college in program planning.

• Industry-wide support of education institutions in training program development and implementation is presently needed and will become even more important in the future.

• With the recognition that 2-year associate degree programs in solar technology are not needed immediately, Federal funding for curriculum development should be contracted to provide adequate time for planning and implementing quality programs. A first condition for funding should be that the project results will benefit all education institutions interested in solar technology.

• The implementation of a comprehensive associate degree solar program should not take place without reasonable assurances that the graduates can be placed.

IDENTIFICATION OF POTENTIAL OBSTACLES TO DEVELOPING AN ADEQUATE TECHNICAL EDUCATION BASE

Findings:

• An inadequate base of information exists concerning current and projected manpower needs and skill requirements. Also inadequate is dissemination of information regarding the state-of-the-art of solar technology in education, industry and Government.

• Only limited funding from state and Federal sources is available to colleges for developmental program research.

• Education, government and industry share the common objective of assuring quality technical support personnel adequately trained to meet manpower demands related to solar technology. However, no coordinated effort exists among these sectors to work cooperatively toward the accomplishment of this mutual objective.

Recommendations

• Federal and state agencies' budget priorities should reflect the need for increased support to colleges, which are working with industry, to determine the human resource development requirements related to this technology.

• State Boards of Education should accept the responsibility of establishing, at the regional level, coordinating mechanisms which will promote cooperative efforts between colleges and industry. This would assure an orderly and timely development of a quality technical education base, with minimal duplication of effort, and stimulate information exchange among interested segments of the region.

• ERDA should assume the leadership role in establishing a National Solar Education Advisory Group. The responsibilities of this group should include coordination of interagency programs and funding activities designed to assist colleges in the development of quality solar-related technical training programs.

Community College Participation by State: **Solar Workshop**

DIALOGUE SUMMARY

Technician Needs

Lewis Leathersich, Management Specialist, Economic Analysis and Industrial Liaison Branch, Division of Solar Energy, presented projected needs for technicians as viewed by ERDA.

- The timing involved in the creation and conduct of solar technology programs is very important. If an oversupply of solar manpower is created for the infant market, many solar installers will be without work. If the market expands at a rate in which technician training cannot keep abreast, future solar development may be discouraged.
- ERDA is presently aware of 25 to 30 courses ranging from 2 days to 2 months, that provide instruction in solar installation. The diversity of courses demonstrates the present lack of consensus on what skills are required, who should be trained, and the length of the course.
- ERDA has contracted a study to identify job categories in the solar industry and to acquire related supply and demand data.

Sheldon Butt, President, Solar Energy Industries Association, indicated that the solar industry is growing at 200 to 300 percent per year. In the first half of 1976 there were 2,000 installations, and 4,000 are expected in the last half of 1976. Over 90 percent of the installations were made in the private sector. By 1980, the Solar Energy Industry Association expects there will be 115,000 to 250,000 individual solar heating and cooling installations per year. Most will be solar water heaters, with 5,000 to 10,000 being space heating. By 1985, projections are for 800,000 to 2,000,000 total installations. By 1987, the total value of installed solar heating and cooling equipment will range between $1.75 billion and $5.5 billion.

- How rapidly the industry grows depends upon what the Government does in terms of incentives.
- Distribution of the solar equipment will be through existing normal channels. Contractors will install the equipment and HVAC people will service them.
- Solar technicians, generally speaking, will work for HVAC contractors, mass-merchandising firms, and local hardware chains. They will usually work for a local entrepreneur, rather than for a large industrial corporation. The need for these solar technicians should be distinguished from technicians required in the solar-electric area.
- Presently, HVAC technicians do not have the additional knowledge about solar energy that they need. Knowledge of collector mounting, of installation of the heat exchange fluid in the collector circuit, and of methods to size installations is required.
- One- or two-weeks' short courses are needed to add to the skills of the existing HVAC technicians. Separate solar technician programs are not needed, but course work in the two-year technician program which relates to solar may be a viable alternate. The solar industry does not need specialized solar technicians.

Lewis Patalita, Manager of Service Training for Carrier Air-Conditioning Company, Syracuse, New York, provided additional insight into the expected growth of the solar industry and technician requirements.

- The goal for ERDA by 1985 is for 10 percent of 200,000 new residential starts to be equipped with solar panels. With each new house needing approximately 800 square feet of panel, the cost of panels and installation, including the supplementary items such as pump and piping for a 2,000 square foot house, could run as much as $14,000.
- With the present state of technology few installations will be solely solar. Booster and backup systems will be required, meaning continued utilization of conventional heating and air-conditioning systems in the foreseeable future.
- Based on the 1970 census, the air-conditioning and refrigeration industry employs 180,000 people. However, without additional data it is not possible to project the census data to any solar categories.
- Solar research and development activities at Carrier are using technicians already involved in other heating and cooling projects. Skill needs for the factory technician involved in solar research include electronic technology, electrical technology, instrumentation technology, computer science, and most importantly, air-conditioning and refrigeration technology.

Upgrading Employed Industry Personnel

Jerry Smith, Training Coordinator Lenox Corp., Marshalltown, Iowa, provided a perspective on how a private industry seeks to fulfill its internal needs in an emerging occupation.

- The objective behind Lenox's job-related training is to support product integrity, to build the dealer's business, and to build his profitability. The hands-on training will be concerned with specific products and systems. Lennox, a multi-product corporation in an emerging industry, cannot afford to sell solar systems to dealers unless they are certified in two phases: (1) systems design and application, and (2) the installation and maintenance of the system. They must be able to interface the solar system with other auxiliary heating and cooling equipment.

• The company feels that beyond the demonstration market in commercial systems, it should put the service and trouble-shooting of commercial applications into job-related training. The fundamentals of residential training programs will be applicable to the commercial market.

Nari Sethna, Director of Training and Education Research for the Refrigeration Service Engineering Society (RSES), Des Plaines, Illinois, discussed his organization.

• The RSES has approximately 30,000 members and 330 chapters throughout the world. It provides approximately 330 classes for 6,000 people per year on occupationally related subjects. RSES works closely with colleges and vocational institutions. RSES will be presenting a trial seminar on solar equipment installation and service to determine the interest within its membership.

Susumi Karaki, Associate Director of the Solar Energy Applications Laboratory, Colorado State University, Fort Collins, explained how the University has defined instructional objectives for those individuals within the solar industry who need immediate training.

Colorado State University has a grant from the Economic Development Administration, Department of Commerce, to develop instructional courses for individual contractors who will not use architects or engineers to design solar systems. The course is entitled "Solar Heating and Cooling of Residential Buildings—The Sizing, Installation, and Operation of Systems." Installers of solar systems need to know enough to install them and make them operational at a cost that will attract clients.

A second course is "The Design of Systems." The goal of the course is to develop the capability among practitioners in the home-building industry to design solar heating and cooling systems. After completing the design course, the trainee should be able to advise clients on the availability of different types of solar systems, to explain the advantages and disadvantages of various systems, to design the heating and cooling system for residential buildings, and to plan and supervise the construction and installation of that system.

David Herrington represented the National Training Fund (NTF) of the Sheet Metal Industry. The NTF is composed of equal representation from the Sheet Metal Workers International Association and the Sheet Metal and Air-Conditioning Contractors Association. Herrington discussed the solar training provided in the sheet metal apprentice and journeyman training programs.

The goals of the NTF are increased employment and increased productivity through training. The NTF publishes text books, develops audio-visual software, supports research on sheet metal uses and application, and supports the training of sheet metal instructors.

• NTF believes that the entry-level technicians will be responsible for the installation of solar systems and will be similar to the HVAC installers that are currently being trained. According to the Sheet Metal Contractors' national news letter, "One important thing that the contractors found is that an experienced sheet metal installer needs little additional training to install the solar system. The typical installation requires 3 days for two experienced sheet metal mechanics."

• Non-standardization of the specifications of solar equipment presently being manufactured by 50 firms makes it unfeasible to train technicians on the operation of all units.

• NTF believes that any qualified sheet metal worker with 3 to 6 hours of training will know enough to install basic solar equipment.

• The craft unions are presently discussing jurisdictional arrangements concerning particular types of solar installation. NTF does not foresee any type of jurisdictional dispute because the unions are cooperating in advance.

During subsequent discussion one participant felt that in communities with organized contractors or individual labor unions with jurisdiction over segments of the industry, education institutions may experience special problems.

• It was recommended that colleges continue to work with HVAC contractors and with technicians who are union members. Colleges could create jurisdictional difficulties if they try to create a technician in a new specialty without coordinating with local labor unions.

Skill Requirements

Robert Middleton, Manager, Commercial Solar Heating and Cooling Demonstration Projects, Marshall Space Flight Center, National Aeronautics and Space Administration, Huntsville, Alabama, shared the experience that NASA has acquired in solar heating and cooling of space crafts in orbit, and in the application of that technology to solar heating and cooling of buildings.

Under ERDA funding and management, NASA performs the rough technical evaluations of commercial demonstration proposals. NASA also manages 32 ERDA-funded sites and is involved in the HUD non-residential solar demonstration program. NASA's goal is to gain knowledge and experience and then to disseminate the information to the solar industry.

• From the work in which NASA has been involved throughout the country it

is evident that additional training for technicians is needed.

• Many people in the conference concluded there probably never will be a course called "solar technician."

• A technician has to be able to communicate in mathematics and computer simulation. A basic understanding of thermodynamics, electrical, electronic, structural and chemical engineering science will be needed by the technician, as well as a basic understanding of building construction. Finally, a concern for scheduling and planning is needed.

• Anyone starting a program is encouraged to have a fully operational solar system to provide students with an understanding of the difference between reality and theory. In planning a solar program, it is suggested that no attempt be made to be perfect but rather set a reasonable short-term goal and schedule a check-point when instructional objectives can be re-evaluated and refined.

Navarro Community College, Corsicana, Texas, as explained by consultant Roy Dugger, has held planning discussions with a regional advisory committee over the past year to focus on the question, "Is there a need for a vocational training program in solar energy?"

The advisory committee was composed of colleges from four states, building trades associations, and local solar industries which determined and published a report affirming the need. (Note: Navarro has recently been funded by ERDA to develop curriculum materials for solar programs.)

Solar Programs and Curriculum

Richard O'Donnell, Associate Professor, explained the Solar Heated and Energy Design Shelters project (SHEDS), at the New Hampshire Vocational Technical College, Manchester, New Hampshire.

• The program has four objectives.

Design and build a house using solar energy as the primary heating source. The structure is to be used as an aid in the education of the public in energy conservation techniques.

Determine additional skill programs or adaptation of existing programs at the college.

Define the skills needed for future trained workers.

Provide New Hampshire public and private enterprises with a model for use in considering future efforts in solar energy designs and construction techniques.

• After the needs assessment and validation by the advisory committee, the planned associate degree program may still require an additional 2 years for approval.

• Educators need to be concerned with informing and assisting the private and community sectors, including building code officials and community and government organizations.

William Aldridge, on appointment to the National Science Foundation from Florissant Valley Community College, in Missouri, expressed the concern as a college faculty member that "lead time" is necessary to develop new curricula and programs to be implemented.

• The issue of solar energy technicians frequently is answered with "we already prepare people with all those competencies. There are no new laws or theories or principles involved." The same thing was said in the 1920's about electronics technicians, but they are readily accepted today.

• A new curriculum will have to be developed to prepare people to install, service, and diagnose difficulties in complete home and industry energy systems. The curriculum may be 80 percent similar to existing curriculum, but with enough significant differences to be called a solar energy technician curriculum. HVAC technicians will not be able to acquire such skills in 3 or 4 months.

Silas Upton, Chairman, Air Conditioning, Solar, Refrigeration Technology, explained the program which San Jose City College in California has developed.

• San Jose City College initially completed a task analysis project which determined the skills required for solar projects are about the same as those of qualified craftsmen in any one of the existing related trades. The program offers a one-course extension of the HVAC program and is providing opportunities for engineering students from San Jose State University to take basic air-conditioning courses.

James Schoenfelder, an architect, who has been involved in all phases of solar development, presented the curriculum he designed for Scott Community College, Bettendorf, Iowa, to train solar technicians.

• The focus of the program is to provide the solar technician with as broad a solar background as possible while emphasizing the heating and cooling area. It is a program which teaches both the fundamental theories of solar conversion and then practical construction and maintenance of these systems. The program is specific in that it identified marketable operational systems. Yet, it is technical enough to allow for the inevitable progress and innovation in the fledging solar industry.

• The program has three planned solar options to be coupled with the four-quarter HVAC programs. The domestic solar option will be one additional quarter with courses in solar residential collectors and heating systems. An additional quarter will cover the industrial solar storage and controls, plus emphasis on servicing all aspects of solar systems. The solar energetics option is four quarters and includes additional design optics and heat transfer theory courses, as well as installation and servicing emphasis.

Donald Irwin, Dean of Instruction, Southwestern Technical Institute, Sylva, North Carolina, discussed the necessity for colleges to explore all opportunities to identify and prepare solar energy instructors.

• In a new area such as solar it is required that a local advisory board be used, as well as existing regional experts to assist in preparing instructors and preparing courses.

• The identification of the instructor should be approached cautiously. As witnessed by the college participants at the conference, being qualified to teach in an allied field is not enough. Potential instructors need initially to be interested in solar energy, and motivated sufficiently to pursue self-study and self-generating activities to become proficient in a bootstrap educational effort.

Equipment and Facilities

Don Mankenberg, Dean, Occupational Studies, Community College of Denver, stated that the Colorado legislature appropriated additional funds during the oil embargo to equip the 303,000 square feet of campus of Denver Community College with a solar heating and cooling system.

• The total cost of the system installed was $820,000, which includes 920 square feet of collectors and a 200,000 gallon storage tank. The system will have controls and can be used as the basis for a solar maintenance program, but to date funds to hire a person to develop the curriculum have not been available.

Other speakers discussing the equipment needed for a solar training program felt that an elaborate or expensive system was not necessary. It is important to have a total operating system. With the expanding number of solar dwellings financed by private parties, as well as by ERDA and HUD, field experience will be available in most all regions of the nation.

Federal Agencies Panel

Introduction

This 2-hour session was conducted in a panel format with Kenneth G. Picha, Director, Office of University Programs, as moderator. The panel members were representatives from nine Federal agencies which are involved in the vital mission of supporting the development of quality technical education and training programs. A brief overview of each participating agency's legislative mandate and involvement in supporting quality education is contained in Appendix E.

This session offered the Federal community the opportunity to receive guidance and input from representatives of education and industry, which are the producers and users of this vital national resource. In the final analysis, it is education, industry, and labor, working cooperatively, that have the responsibility for result-oriented action leading to the continuation of quality technical education.

Recommendations

- Interagency agreements between the Federal agencies involved in energy-related manpower technologies should be developed to enhance cooperation.
- Information on actual funding of energy-related manpower activities should be shared by all agencies participating in the Conference.
- Each agency should review funding priorities to determine whether current appropriations and programs can be redirected or expanded to meet training needs at the less-than-baccalaureate level.
- The Federal Government should take the lead in establishing a study panel to recommend means for overcoming institutional and other barriers which inhibit full college participation in the development of human resources in the energy field.
- Human resources should be incorporated as a discrete building block by planners of the Nation's energy policy so that manpower constraints can be identified and more effectively dealt with by the educational community.

DIALOGUE SUMMARY

Kenneth Picha, Director, Office of University Programs, explained ERDA's interest in the Conference and in working with colleges.

- ERDA must enlist the support of all segments of education establishments to carry out its research and development programs. ERDA will use input from this Conference for directions on how the Agency should utilize resources of education, organized labor and industry.
- ERDA is charged by the Congress to take full advantage of existing technical expertise, particularly in the private sector, in the conduct of the energy R&D program (PL 93-577). ERDA also must seek the widest possible dissemination and application of scientific and technical information relating to emerging energy technologies. Further, Congress has directed ERDA to carry out energy manpower supply and demand assessments and, through education and training activities, to assure adequate manpower for energy R&D programs (PL 93-438). Since education institutions constitute a major national resource with a wide range of capabilities matching ERDA's requirements, they can contribute to the National Energy RD&D Program through their traditional missions of research, training, and public service.
- Colleges and universities are recognized as an important resource to aid ERDA with regional problems and issues through research, training, and extension services for business-industry and state-local government.

Harold Rieve, Chief, Division of National Training Programs, Employment and Training Administration, U.S. Department of Labor (DOL), in collaboration with *Robert J. Brown, DOL Regional Administrator, Region VIII,* presented a national manpower overview. Since the Conference, Bob Brown has been selected as Under Secretary, U.S. Department of Labor.

The Department of Labor is interested in the manpower needs for energy development, recognizing there are three major factors to consider: demand, supply, and the distribution of manpower. In matching the need with the supply there are disparities. In minimizing the disparities, two activities are proposed: increase the labor supply quantitatively,

and increase the efficiency and utilization of the existing labor supply.

- The real problem is the result of dislocations in the flow of labor from one region to another. A labor supply and demand data system is needed to anticipate future changes in manpower requirements. Also needed is a sophisticated job market information system.
- The magnitude of increased employment in the energy sector will be small relative to the economy's total employment. Shortages are expected to appear in high-technology occupations. Most energy development will occur in sparsely populated rural areas.
- The Employment and Training Administration is seeking the cooperation of unions, employers, Federal and state agencies, and education institutions to meet these needs and to develop a plan for furnishing the necessary manpower as it will be required.
- Until congressional and administrative mandates are clearly developed into a national energy and manpower plan, it will be difficult to project future manpower requirements.

Walter J. Brooking, Program Specialist, Division of Vocational and Technical Education, spoke on the role of the Office of Education (OE) as a manpower producer. Dr. Brooking outlined the programs of the OE, stressing the technical assistance and financial aid provided to education institutions and the states.

OE administers the Vocational Education Act of 1963, as amended in 1976, which provides funds to the states. A substantial amount of that money is spent at community and junior colleges. Limited funds are available for research and development of instructional materials. Experience dictates that gathering information should be the first step for an education institution in determining areas of the work force which its students should be prepared to enter.

- When sufficient evidence is present, an advisory group consisting of representation from organized labor and industry should be established to determine the number of people needed and the skills required.
- OE believes a program should not be started unless it has a probable 10-year life. It normally takes 5 years to start a new program, if it is done right: it will take as long as 2 years to conduct a feasibility study, and 1 year to locate and employ a competent department head. To prepare the facilities, equipment and instructional materials, and to staff and recruit students for the program, will total 5 years. Usually, unless there is a probability of at least 25-40 graduates per year being placed, a program should not be started.
- Potential fields for energy production are many. One of the most important aspects of starting a program in energy will be the cooperation of employers and labor unions. Graduates need to have skills which have a tangible value on the job at the beginning or very shortly after their employment.
- After the institution has become excited about the possibility of an energy technology program and has devoted considerable time to conducting a study, it does not necessarily mean that a program should be started.

Don Cook, Office of Federal Activities, Environmental Protection Agency, explained the responsibilities of Federal agencies as manpower users.

"User agency" refers to an agency that is pursuing a definite legislative objective. Examples are: ERDA—promoting increased use of nuclear or solar energy; Mining Enforcement and Safety Administration—working to maximize safety in mining; Environmental Protection Agency—trying to reduce emissions from power stations.

- Most agencies are authorized to support education and training activities in their efforts but few are required to do it. Usually, it is a situation of having to verify and prove the value of education and training support activities in relation to other agency priorities and needs.
- There is a tendency for the Federal Government to support a greater diversity of programs than is needed. The pattern should be to fund a few programs and then discuss and encourage adoption of exemplary activities through conferences such as this.
- EPA's role will be related to providing job descriptions in critical resource preservation and conservation areas, developing and updating sample curricula, and predicting and highlighting needs assessment. EPA will enter interagency agreements with other Federal and state agencies that have responsibility for the conduct of training.

- The program-oriented agencies want human resources that can help meet their needs. They do not want human resources to be a constraint on their programs' missions.
- Needs tend to be great when they are aggregated on a national basis. On a local basis they are often small, and many factors have to be taken into account.
- In 1968, a Senate document that analyzed EPA's education and training effort required EPA to work with state and local education delivery systems rather than create a new system. Experience has demonstrated that the community college system can get the job done and can support the efforts of user agencies.

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Higher Education Panel

Introduction

The Higher Education Workshop panel was composed of participants from five state boards with differing responsibilities over vocational and technical education. The state boards represented had records of commitment to energy-related technology programs, and had experience in supporting and evaluating such programs.

The informal discussions by the panel included summaries of existing and planned energy-related program offerings within the states.

Impediments to developing sound programs in community colleges were enumerated by the panel members, as well as suggestions for better state board coordination and support.

The audience-panel dialogue contained several recommended actions that state boards should take to assist colleges in improving the quality of their programs.

Findings

- Impediments to developing new technology training programs include:
  - program offerings limited to local manpower requirements and jurisdictions,
  - local labor demands in a singular college district may not warrant establishment of a program, although the state-wide or regional demands are substantial;
  - access to specialized equipment and expert training staff may be restricted through costs frequently prohibitive to a local college
- State control of education is increasing and approval of additional college programs requires a thorough review.
- State boards provide an important linkage with the Federal Government, which can be very valuable in establishing energy-related programs.

Recommendations

- Efforts should be made to avoid unnecessary competition among colleges for development of expensive energy programs. Such competition is perpetrated in part by program development procedures which state boards impose on community colleges.
- State boards should be concerned with improving information sharing mechanisms among colleges.
- State boards should seek reciprocal agreements between neighboring states and their community colleges' districts to foster:
  - quality technology programs for regional demands,
  - student exchange,
  - instructor sharing,
  - reduction of duplicate program offerings.

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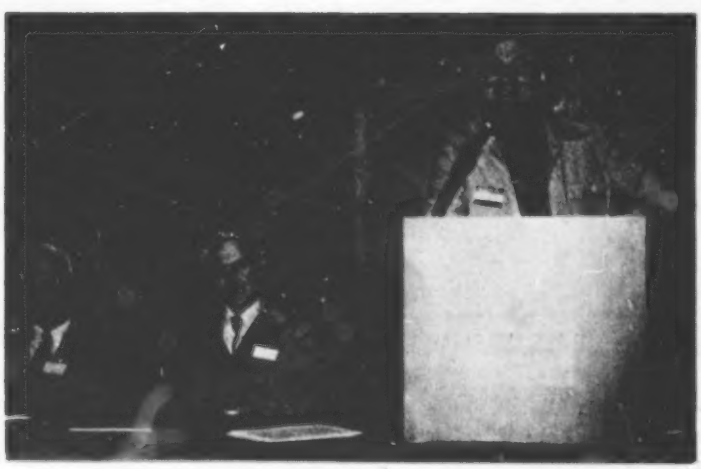

Closing Remarks

The closing session consisted of a summary of findings and recommendations for each of the four energy technology workshops. This is included in the respective workshop sections of these proceedings.

In planning the Conference, the college coordinators requested that in the closing session AACJC and ERDA indicate to the participants that they had heard the concerns of education, industry and organized labor regarding the development and maintenance of quality programs.

Below are concluding responses made by Richard E. Wilson of the American Association of Community and Junior Colleges (AACJC) and by James R. O'Gwin of the Energy Research and Development Administration.

Richard E. Wilson, Vice President for Programs, responded for AACJC from its perspective of representing 2-year institutions. Community and junior colleges recognize the complexity of the four energy technologies and that each could be subdivided into additional specialty areas. Education institutions too often have been concerned about the value of specialized divisions, when, as the workshops have demonstrated, the advantages are in borrowing from the broad constituency of persons in a particular technology area.

A division mentioned is the potential polarization between theory and practice in any technological area. Whether one starts from an academic perspective, a task analysis, or an advisory committee, the desired results are effective, well-qualified, valued people. Quality: How is quality evaluated? Accreditation, whether specialized and regional, still looks primarily at the inputs: the money spent per student, the laboratories and equipment, and the instructor's credentials. Specialized accreditation is also political and frequently is used as internal leverage.

Education should spend more time looking at outputs, conducting follow-up studies, and communicating with employers.

The recommendation from the workshops, that societies interested in each energy sector should organize, is a good one. Such a group can sponsor curriculum development, conduct studies and surveys, exchange information and expand cooperation among education, industry, labor and government.

James R. O'Gwin, Assistant Director, Contractor Manpower, Division of Labor Relations, indicated that ERDA staff had been attentive. This Conference is in the past. It is a step. The proceedings will be another step toward the stated objective for this Conference. Each sector must accept its responsibility and the ownership for what took place during the Conference by extracting those things which are relevant.

ERDA will accept its responsibility to continue to support the members of its vital partnership. ERDA is a support agency to the Department of Labor and the Office of Education in educating and training of the Nation's work force, and it will continue to be a catalyst to support quality technical energy-related education.

ERDA and AACJC co-sponsored the Conference and had numerous staff members participating in the individual workshops. However, both organizations attended the Conference with the objective of listening and sharing ideas with the many participants who have a mutual concern for quality technical education. ERDA believes in the ability of the community and technical college systems to deliver quality technical support personnel. ERDA believes in the commitment of industry to work with education institutions to train technical support personnel and the commitment of labor to work with skilled development processes for technical and skilled craft personnel. The co-sponsors also believe in the ability of those Federal agencies with legislative mandates to support this partnership and to pursue the quality education of the work force.

APPENDIX A

ATTN:

Dear

The U.S Energy Research and Development Administration and the American Association of Community and Junior Colleges invite a representative of your college to attend a national conference on Energy Technology Training to be held October 27-29, 1976, at the Century Center Motor Hotel in Atlanta, Georgia.

The conference agenda includes recommendations and suggestions from colleges which are conducting or planning to conduct energy technology programs. Four energy training technology workshops will be conducted concurrently in the areas of: coal mining, nuclear, petroleum, and solar. Energy education issues will be presented in a panel format by staff from community colleges, energy-related industries and associations, organized labor, and Federal and state agencies. Topics will include supply and demand projections for technician and paraprofessional personnel, skill requirements for industrial employment, obstacles to program development, and improved cooperation among education, industry, and Government.

Only colleges with energy technology programs or plans to implement energy programs have been invited to send representatives to this conference. Your college has been identified as being involved in the planning or implementation of a technology program and is cordially invited to actively participate in the workshop which will address this subject area. We suggest that your representative be an individual who is involved in the instruction or development of the college's energy education program.

The purpose of the conference is not to identify Federal financial assistance for developing or expanding energy-related technical programs; rather, emphasis will be on establishing a cooperative relationship supportive of quality technical education in energy-related occupational fields.

Proceedings will be published with findings and recommendations on the role, responsibility and recommended action for education, industry, labor and Government.

Please complete and return the enclosed conference registration card by September 27, 1976. The conference coordinator, Oak Ridge Associated Universities, will contact planned attendees to serve as workshop discussants for scheduled topics.

Conference inquiries should be directed to John Doggette at Oak Ridge Associated Universities, P.O. Box 117, Oak Ridge, Tennessee 37830 or telephone (615) 483-8411 ext. 222.

Your interest and cooperation are appreciated and we look forward to your active participation in the conference.

Sincerely,

Enclosures
Conference Fact Sheet
Registration Card
Center Literature

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APPENDIX C Energy Technology Training Conference Post-Conference Questionnaire

Please fill out the questionnaire as completely as possible. If you did not attend the total conference answer all appropriate questions:

I represent

_____community or technical college
_____industry/professional organization or association
_____state organization
_____Federal agency
_____organized labor
_____other (specify)_____

I attended the following energy workshop:

_____coal-mining
_____nuclear
_____petroleum
_____solar

My conference objectives were:

_____

_____

_____

_____

How well did the Energy Technology Training Conference fulfill its stated objectives? (See agenda for objectives.)

_____very well _____good _____fair _____poor

In the energy workshop that you attended, please rate the following:

	EXCELLENT	GOOD	FAIR	POOR
Overall conference coordination				
Workshop coordination				
Moderator				
Recorder				

In your energy workshop, please rate the quality of content with regard to the following topics:

	EXCELLENT	GOOD	FAIR	POOR
1. Projected Needs for Technicians				
2. Skill Requirements				
3. Curriculum				
4. Instructor, Student Work Experiences and Instruction Equipment				
5. Industry Assessment of Community College Programs				

In your energy workshop, please rate the depth of coverage with regard to the following topics:

	EXCELLENT	GOOD	FAIR	POOR
1. Projected Needs for Technicians				
2. Skill Requirements				
3. Curriculum				
4. Instructor, Student Work Experiences and Instruction Equipment				
5. Industry Assessment of Community College Programs				

How would you rate the Federal Agency Workshop in providing a better understanding of federal agencies' concern for energy technology training?

_____excellent _____good _____fair _____poor

How would you rate the Higher Education Board workshop in providing a better understanding of state education concerns and policies toward existing and planned technology programs?

_____excellent _____good _____fair _____poor

How appropriate were the issues and recommendations for action that were identified in your energy workshop?

_____very appropriate _____good _____fair _____poor

To be answered by community colleges with existing energy programs:

Will the conference aid your college in improving its existing program?

_____yes _____limited use _____little or no use

To be answered by community colleges with planned energy programs:

Will the conference aid your college in decision-making on whether or not to establish an energy program?

_____yes _____limited use _____little or no use

Will your conference participation be beneficial toward establishing the instructional content, if a program is initiated?

_____yes _____limited use _____little or no use

To be answered by representatives from industry, organized labor and professional associations:

Will the conference aid your developing better working relationships with community colleges in energy technology training?

_____yes _____limited use _____little or no use

To be answered by representatives from Federal and state agencies only:

How beneficial was the conference in providing a better understanding of the issues involved in community colleges establishing or expanding energy technology programs.

_____very beneficial _____good _____fair _____poor

General comments, criticisms, and recommendations (use back page, if necessary).

Post-Conference Questionnaire Results

At the conclusion of the Energy Technology Training Conference participants were requested to evaluate its quality and usefulness. From a total attendance of 183, 125 or sixty-eight percent responded to twenty-eight items on a post-conference questionnaire.* Because 11 participants attended more than one workshop, the total participation in the four energy technology workshops exceeds the total of all conference participants. For purposes of analysis certain items have been combined into single tables. The resoonse rate is lower for State Organizations than for the remaining representative groups. This is partially due to several state board representatives having to leave prior to the conference adjournment.

Table 1: **Conference Attendance**

Organization Representatives	*Participants*	*No. Responding*	*% Response*
Education Institutions	117	89	76
Industry/Professional Organizations	28	17	61
State Organizations	9	3	33
Federal Agencies	26	13	50
Organized Labor	3	3	100
Totals[1]	**183**	**125**	**68**
Workshop Participation			
Coal Mining	42	37	88
Nuclear	49	37	76
Petroleum	37	29	78
Solar	59	33	56
Totals[1]	**187**[2]	**136**	**73**

[1] Totals do not agree because 11 participants attended two or more workshops.

[2] Seven conference participants did not indicate attendance at any of the above workshops.

[3] The nine conference staff members are excluded from this number. Therefore, the total conference participation was 192.

Table 2 summarizes the responses to how well did the Energy Technology Conference fulfill its stated objectives?

Table 2: **Fulfillment of Objectives**

Organization Representatives	*No. Responding*	*Excellent/Good*	*Fair/Poor*
Education Institutions	84	79= 94%	5= 6%
Industry/Professional Organizations	16	14= 88%	2=12%
State Organizations	3	3=100%	–
Federal Agencies	13	11= 85%	2=15%
Organized Labor	3	2= 67%	1=33%
Totals	**119**	**109= 92%**	**10= 8%**
Workshop			
Coal Mining	37	35= 95%	2= 5%
Nuclear	35	34= 97%	1= 3%
Petroleum	28	26= 93%	2= 7%
Solar	32	26= 81%	6=19%
Totals	**132**	**121= 92%**	**11= 8%**

The results are presented in Tables 3 and 4 of how the respondents rated the conference and workshop coordination.

Table 3: **Conference Coordination**

Organization Representatives	*No. Responding*	*Excellent/Good*	*Fair/Poor*
Education Institutions	83	81= 98%	2= 2%
Industry/Professional Organizations	16	14= 88%	2=12%
State Organizations	3	3=100%	–
Federal Agencies	13	13=100%	–
Organized Labor	3	3=100%	–
Totals	**118**	**114= 97%**	**4= 3%**
Workshop			
Coal Mining	37	37=100%	–
Nuclear	35	33= 94%	2= 6%
Petroleum	27	27=100%	–
Solar	31	29= 93%	2= 7%
Totals	**130**	**126= 97%**	**4= 3%**

Table 4: **Workshop Coordination**

Organization Representatives	*No. Responding*	*Excellent/Good*	*Fair/Poor*
Education Institutions	86	85= 99%	1= 1%
Industry/Professional Organizations	17	14= 82%	3=18%
State Organizations	3	3=100%	–
Federal Agencies	13	13=100%	–
Organized Labor	3	3=100%	–
Totals	**122**	**118= 97%**	**4= 3%**
Workshop			
Coal Mining	37	36= 97%	1= 3%
Nuclear	36	35= 97%	1= 3%
Petroleum	29	29=100%	–
Solar	33	31= 94%	2= 6%
Totals	**135**	**131= 97%**	**4= 3%**

The respondents were asked to rate the quality of content for the workshop attended with regard to the major topics covered. Table 5 illustrates the summary responses.

Table 5: **Quality of Content—All Workshops**

Topic	*No. Responding*	*Excellent/Good*	*Fair/Poor*
Projected Needs	116	82= 71%	34=29%
Skill Requirements	118	93= 79%	25=21%
Curriculum	118	93= 79%	25=21%
Student Work Experiences	113	85= 75%	28=25%
Industry Assessment of Community College Programs	115	82= 71%	33=29%
Mean	**116**	**87= 75%**	**29=25%**
Projected Needs			
Workshop			
Coal Mining	37	25= 68%	12=32%
Nuclear	36	26= 72%	10=28%
Petroleum	26	18= 69%	8=31%
Solar	30	23= 77%	7=23%
Totals	**129**	**92= 71%**	**37=29%**
Skill Requirements			
Coal Mining	37	29= 78%	8=22%
Nuclear	35	29= 83%	6=17%
Petroleum	28	24= 86%	4=14%
Solar	31	20= 64%	11=36%
Totals	**131**	**102= 78%**	**29=22%**
Curriculum			
Coal Mining	37	31= 84%	6=16%
Nuclear	35	30= 86%	5=14%
Petroleum	28	27= 96%	1= 4%
Solar	30	16= 53%	14=47%
Totals	**130**	**104= 80%**	**26=20%**
Student Work Experiences			
Coal Mining	35	30= 86%	5=14%
Nuclear	35	26= 74%	9=26%
Petroleum	26	22= 85%	4=15%
Solar	29	17= 59%	12=41%
Totals	**125**	**95= 76%**	**30=24%**
Industry Assessment of Community College Programs			
Coal Mining	34	30= 88%	4=12%
Nuclear	36	24= 67%	12=33%
Petroleum	25	18= 72%	7=28%
Solar	29	18= 62%	11=38%
Totals	**124**	**90= 73%**	**34=27%**

Table 6 indicates that the respondents also felt that the depth of coverage was very good in the workshops.

Table 6: **Depth of Coverage—All Workshops**

Topic	*No. Responding*	*Excellent/Good*	*Fair/Poor*
Projected Needs	116	79= 68%	37=32%
Skill Requirements	115	94= 82%	21=18%
Curriculum	114	83= 73%	31=27%
Student Work Experiences	115	79= 69%	36=31%
Industry Assessment of Community College Programs	113	69= 61%	44=39%
Mean	**115**	**81= 70%**	**34=30%**
Projected Needs			
Workshop			
Coal Mining	36	24= 67%	12=33%
Nuclear	36	25= 69%	11=31%
Petroleum	26	14= 54%	12=46%
Solar	30	24= 80%	6=20%
Totals	**128**	**87= 68%**	**41=32%**
Skill Requirements			
Coal Mining	36	30= 83%	6=17%
Nuclear	34	28= 82%	6=18%
Petroleum	27	25= 93%	2= 7%
Solar	30	21= 70%	9=30%
Totals	**127**	**104= 82%**	**23=18%**
Curriculum			
Coal Mining	34	27= 79%	7=21%
Nuclear	33	28= 85%	5=15%
Petroleum	27	24= 89%	3=11%
Solar	29	12= 41%	17=59%
Totals	**123**	**91= 74%**	**32=26%**
Student Work Experience			
Coal Mining	35	31= 89%	4=11%
Nuclear	35	22= 63%	13=37%
Petroleum	27	22= 81%	5=19%
Solar	29	13= 45%	16=55%
Totals	**126**	**88= 70%**	**38=30%**
Industry Assessment of Community College Program			
Coal Mining	36	29= 80%	7=20%
Nuclear	35	18= 51%	17=49%
Petroleum	26	19= 73%	7=27%
Solar	28	11= 39%	17=61%
Totals	**125**	**77= 62%**	**48=38%**

In evaluating the Federal Agencies Workshop 67 percent of the respondents said that the federal agencies participants did an excellent or good job in providing a better understanding of federal agencies concern for energy technology training. Table 7 provides the summary response by category of participation.

Table 7. **Federal Agencies Workshop**

Organization Representatives	*No. Responding*	*Excellent/Good*	*Fair/Poor*
Education Institutions	81	59= 73%	22=27%
Industry/Professional Organizations	15	13= 87%	2=13%
State Organizations	3	3=100%	–
Federal Agencies	12	10= 83%	2=17%
Organized Labor	2	2=100%	–
Totals	**113**	**87= 77%**	**26=23%**

The state higher education board workshop received an excellent to good rating by 62 percent of the respondents. Table 8 shows how well the respondents felt the state agencies representatives demonstrated their concern and policies toward existing and planned technology programs.

Table 8. **Higher Education Board Workshop**

Organization Representatives	*No. Responding*	*Excellent/Good*	*Fair/Poor*
Education Institutions	73	41= 56%	32=44%
Industry/Professional Organizations	8	7= 88%	1=12%
State Organizations	3	1= 33%	2=67%
Federal Agencies	6	6=100%	–
Organized Labor	1	1=100%	–
Totals	**91**	**56= 62%**	**35=38%**

The appropriateness of the issues and recommendations for action that were identified in the workshops received a favorable rating by 86 percent of the respondents as summarized in Table 9.

Table 9. **Issues and Recommendations—All Workshops**

Organization Representatives	*No. Responding*	*Excellent/Good*	*Fair/Poor*
Education Institutions	79	69= 87%	10=13%
Industry/Professional Organizations	17	15= 88%	2=12%
State Organizations	3	2= 67%	1=13%
Federal Agencies	11	9= 82%	2=18%
Organized Labor	3	2= 67%	1=33%
Totals	**113**	**97= 86%**	**16=14%**
Appropriateness of Issues and Recommendations			
Workshop			
Coal Mining	33	30= 91%	3= 7%
Nuclear	35	30= 86%	5=14%
Petroleum	25	19= 76%	6=24%
Solar	31	26= 84%	5=16%
Totals	**124**	**105= 85%**	**19=15%**

Ninety-six percent of the respondents from colleges with existing energy technology programs indicated that the conference will aid their college in improving their existing energy related technology programs; 98 percent of the respondents from colleges planning energy programs said that the conference results will definitely aid their colleges in decision-making on whether or not to establish energy programs; and 98 percent of all respondents from education institutions felt that their conference participation will be beneficial toward establishing the instructional content, if a program is initiated. The responses by workshop are presented in Tables 10-12.

Table 10 **Aid in Improving Existing Program**

Workshop	*No. Responding*	*Excellent/Good*	*Fair/Poor*
Coal Mining	16	16=100%	–
Nuclear	18	16= 89%	2=11%
Petroleum	10	10=100%	–
Solar	7	7=100%	–
Totals	**51**	**49= 96%**	**2= 4%**

Table 11 **Aid in Decision Making**

Workshop	*No. Responding*	*Excellent/Good*	*Fair/Poor*
Coal Mining	5	5=100%	–
Nuclear	16	16=100%	–
Petroleum	12	11= 92%	1=87%
Solar	17	17=100%	–
Totals	**50**	**49= 98%**	**1=27%**

Table 12 **Beneficial Toward Establishing Instructional Content**

Workshop	*No. Responding*	*Excellent/Good*	*Fair/Poor*
Coal Mining	5	5=100%	–
Nuclear	17	17=100%	–
Petroleum	11	11=100%	–
Solar	18	17= 94%	1= 6%
Totals	**51**	**50= 98%**	**1= 2%**

All industry, organized labor and professional association respondents to item 27 stated that the conference dialog will aid in developing better working relationships with community colleges in energy technology training. Respondents to item 28 from federal and state agencies indicated that the conference did will in providing a better understanding of the issues involved in community colleges establishing or expanding energy technology programs.

APPENDIX D: Conference Agenda

Wednesday, October 27, 1976

GENERAL SESSION

Welcoming Remarks
James O'Gwin, Assistant Director
Division of Labor Relations, ERDA

ERDA Mission and Organization
R. G. Romatowski
Assistant Administrator for Administration, ERDA

Community Colleges: Primary Producer Skilled Technical Personnel
Richard E. Wilson
Vice President for Programs, AACJC

Manpower Demand/Supply: State of the Art
Norman Seltzer, Chief
Manpower Assessment Office, ERDA

Thursday, October 28, 1976

LUNCHEON SPEAKER

Eric Willis
Assistant Administrator for Institutional Relations
ERDA

Friday, October 29, 1976

CONFERENCE CLOSING MODERATOR

J. Faherty Casey
Division of Labor Relations
ERDA

NUCLEAR TECHNOLOGY WORKSHOP

Carroll Marsalis, Chairman, Career Education, *Coordinator*
Roane State Community College
Harriman, Tennessee

Pete Charton, Associate Professor *Moderator*
Roane State Community College
Harriman, Tennessee

Chris Keim, Physicist, *Recorder*
Oak Ridge National Laboratory (Retired)

Wednesday, October 27, 1976

MORNING

The ERDA Nuclear Mission
Bill Savage, Senior Evaluation Engineer, Divsion of Nuclear Research and Applications, Energy Research and Development Administration, Washington, D.C.

The Need for Technicians in the Nuclear Fuel Cycle
Fred Merklin, Assistant Director, Center for Nuclear Studies, Kansas State University, Manhattan, Kansas

Projected Needs For Technicans
Paul Shoop, National Representative, International Brotherhood of Electrical Workers, Washington, D.C.

R. B. Neel, Chairman, Nuclear Technology Department, Midland Technical College, Columbia, South Carolina

Wyatt Rogers, Associate Director, Western Interstate Nuclear Board, Lakewood, Colorado

Scott W. Fellows, Director of Applied Research and Technology, Southern Interstate Nuclear Board, Atlanta, Georgia

AFTERNOON

Projected Needs for Technicians (Continued)

Industry Assessment of Areas in Which Community Colleges Should Train
Denny Smith, Instructor, Nuclear Energy Technology, Terra Technical College, Fremont, Ohio

Paul Witherell, Dean, Wentworth Institute, Boston, Massachusetts

Ken McCoy, Assistant Plan Supervisor, Mississippi Power and Light Company, Jackson, Mississippi

Skill Requirements for Entry-Level Technicians
George J. Stoll, Nuclear Training Specialist, Babcock and Wilcox, Lynchburg, Virginia

J. L. Hubbard, Manager of Personnel, Division of Nuclear Power Generation, Babcock and Wilcox, Lynchburg, Virginia

Thursday, October 28, 1976

MORNING

William R. Casto, Consultant Examiner, U.S. Nuclear Regulatory Commission, Oak Ridge National Laboratory, Oak Ridge, Tennessee

Clifford Beck, Assistant to the Director for Research Applications, U.S. Nuclear Regulatory Commission, Bethesda, Maryland

Gilbert Stone, Environmental Engineer, Division of Power Production, Tennessee Valley Authority, Chattanooga, Tennessee

Carl Schwing, Executive Director, Middle Atlantic Applied Technology Institute, Charles County Community College, La Plata, Maryland

Ed Dewell, Associate Professor, Nuclear Technology, Center Virginia Community College, Lynchburg, Virginia

AFTERNOON

Instructor Qualifications for Nuclear Technology Training
Wayne Jones, Director, Center for Nuclear Studies, Memphis State University, Memphis, Tennessee

Clay Johnson, vice-President for Instruction, Texas State Technical Institute, Waco, Texas

Student Work Experiences Programs
Arden Bicker, Environmental Sciences Department Manager, Reynolds Electrical & Engineering Co., Inc., Las Vegas, Nevada

James Walters, Director, Division of Applied Sciences, Central Florida Community College, Ocala, Florida

Nuclear Technology Curriculum—Flexible or Standardized?
Daniel Hull, Manager, Southwest Office, Technical Education Research Center, Waco, Texas

Certification of Nuclear Technology Programs—Is It Needed?
James Smathers, Chairman, Education Committee of American Nuclear Society, Texas A&M University, College Station, Texas

Friday, October 29, 1976

MORNING

Workshop Issues and Recommendations

General Session

Conference Closing Remarks

SOLAR TECHNOLOGY WORKSHOP

Robert N. Illingsworth, Director, Research and Development, *Coordinator*
Scott Community College
Bettendorf, Iowa

O. C. Burnell, *Moderator*
Director, Career Education, Scott Community College, Bettendorf, Iowa

Paul Greene, *Recorder*
Director of Resource Development, Navarro College, Corsicana, Texas

Wednesday, October 27, 1976

MORNING

The ERDA Solar Mission
Lewis Leathersich, Management Specialist, Economic Analyst and Industrial Liaison Branch, Division of Solar Energy, Energy Research and Development Administration, Washington, D.C.

Projected Needs for Technicians
Sheldon Butt, President, Solar Energy Industry Association, Director, Market Research and Planning, Olin Brass, Olin Corporation, East Alton, Illinois

Louis Patalita, Manager, Service Training Department, Carrier Air Conditioning Company, Syracuse, New York

Roy Dugger, Special Consultant to Navarro College, Corsicana, Texas

Lewis Leathersich, Management Specialist, Economic Analyst and Industrial Liaison Branch, Division of Solar Energy ERDA

Bill G. Aldridge, Program Manager, MODES Task Force, Division of Science Education and Research, National Science Foundation, Washington, D.C.

AFTERNOON

Continuing Education for Technician Solar Personnel
Jerry Smith, Training Coordinator, Lennox Corporation, Marshalltown, Iowa

Nari Sethna, Director of Training and Educational Research, Refrigeration Service Engineering Society, Des Plaines, Illinois

Equipment Requirements in the Solar Industry
Donald Mankenberg, Dean of Occupational Studies, North Campus, Community College of Denver, Denver, Colorado

Skill Requirements for Entry-Level Technicians
S. Karaki, Associate Director, Solar Energy Applications Laboratory, Colorado State University, Fort Collins, Colorado

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Skill Requirements for Entry-Level Technicians (Continued)
Jerry Smith, Training Cordinator, Lennox Corporation, Marshalltown, Iowa

Robert Middleton, Site Manager, Solar Heating and Cooling Commercial Demonstration Projects, Marshall Space Flight Center, NASA, Huntsville, Alabama

David Herrington, Administrative Assistant for Technological and Educational Programs, National Training Fund for Sheet Metal Industry, Sheet Metal Workers' International Association, Washington, D.C.

Solar Technology Curriculum
Richard M. O'Donnell, Associate Professor, New Hampshire Vocational Technical College, Manchester, New Hampshire

James L. Schoenfelder, Head of Energy Management Department, Architect, Hansen, Lind & Meyer, Iowa City, Iowa; Consultant to Scott Community College, Bettendorf, Iowa

AFTERNOON

Instructor Qualifications—The Need for Training and Upgrading Instructors
Donald N. Irwin, Dean of Instruction, Southwestern Technical Institute, Sylva, North Carolina

Discussion Panel

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Workshop Issues and Recommendations

General Session

Closing Remarks

COAL MINING TECHNOLOGY WORKSHOP

John Gwaltney, President, *Coordinator*
Wabash Valley College
Mt. Carmel, Illinois

Chuck Harrison, Manager, *Moderator*
Employee and Program Development
AMAX Coal Company
Indianapolis, Indiana

Gordon Ward, President, *Recorder*
Northern Wyoming Community College
Sheridan, Wyoming

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The Law(s) and Contract Requirements for Training and Certification in Shaft Mining and Surface Mining—Mandatory Training Requirements
Murray Rottenberg, Manpower Development Specialist, Education and Training, U.S. Mining Enforcement and Safety Administration, U.S. Department of the Interior, Washington, D.C.

Skill Requirements
Shaft Mining
Rod Linder, Division Chairman
Wabash Valley College
Mt. Carmel, Illinois

Surface Mining
James Phipps, Instructor/Coordinator
Indiana Vocational Technical College, Terre Haute, Indiana

AFTERNOON

Projected Manpower Needs
Bernard Friedman, Consultant to Division of Fossil Energy, Energy Research and Development Administration, Washington, D.C.

Ron Sanderson, Dean of Instruction, Wabash Valley College, Mt. Carmel, Illinois

Ted Renner, Principal Investigator, State of North Dakota, Department of Vocational Education, Bismarck, North Dakota

Industry Assessment of Community College Training Programs
Chuck Harrison, Manager, Employee and Program Development, AMAX Coal Company, Indianapolis, Indiana

Myles Altimus, Director of Manpower, Peabody Coal Company, St. Louis, Missouri

Instructor Qualifications, Equipment and Student Work Experience
Revonda Williams, Director of Mining Technology Program, Mountain Empire Community College, Big Stone Gap, Virginia

Ted Cross, Director, Career Studies, Casper College, Casper, Wyoming

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Supervisory Training
Kenneth Moody, General Management Development, U.S. Steel, Inc., Pittsburgh, Pennsylvania

George Kyle, Project Director, Mining Technology Corporation, Madisonville Community College, Madisonville, Kentucky

Curriculum—Flexible or Standardized?
Duane Leicher, Assistant Professor, Mining Extension Service, West Virginia University, Morgantown, West Virginia

Ed Hayduk, Center for Continuing Education, Pennsylvania State University, University Park, Pennsylvania

Michael Bishara, Chairman, Engineering Division, S.W. Virginia Community College, Richland, Virginia

AFTERNOON

Economies of Scale
John Gwaltney, President, Wabash Valley College, Community College of Eastern Illinois, Mt. Carmel, Illinois

Gordon Ward, President, Northern Wyoming Community College, Sheridan, Wyoming

What Industry Can Do to Assist New and In-Place Programs
John Mahaffey, Product Manager, Joy Manufacturing Company, Franklin, Pennsylvania

What the MESA Academy Can Do to Assist New and In-Place Programs
Robert McKeand, Assistant Superintendent, Federal Mine and Safety Academy, U.S. Mining Endorcement and Safety Administration, U.S. Department of the Interior, Beckley, West Virginia

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General Session

Closing Remarks

PETROLEUM TECHNOLOGY WORKSHOP

Dwight Link, Dean of Instruction, *Coordinator*
Lincoln Trail College
Robinson, Illinois

Edwin O'Neal, Chairman, *Recorder*
Department of Petroleum Engineering Technology
Delgado Junior College
New Orleans, Louisiana

Ed McKay, Program Coordinator
Petroleum Technology
Moderator
Lincoln Trail College
Robinson, Illinois

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ERDA Petroleum Research and Development Mission
William Eckard, Senior Technical Advisor for Fossil Energy, Energy Research and Development Administration, Washington, D.C.

World Energy Needs
Walter Bovaird, Senior Petroleum Economist, Marathon Oil Company, Findley, Ohio

Projected Needs for Technicians

Needs for Technical Personnel
Wayne Horman, Education Coordinator, Oil, Chemical and Atomic Workers, International Union, Denver, Colorado

An Approach to Identifying Technician Needs
Joshua Hill, Petroleum Technology, Texas Southern University, Houston, Texas

AFTERNOON

Skill Requirements for Entry-Level Technicians
Offshore Rigs' Technical Skills

Lloyd Ramirez, Chief of Producing Operations, Southern Region, Shell Oil Company, New Orleans, Louisiana

Should a Petroleum Technology Program for Offshore Exploration Needs be Developed?
Charlotte Purnell, Dean of Development for Deleware Technical and Community College, Georgetown, Delaware

Directional Drilling Application to Petroleum Technology
Jerry Silver, Training Development Specialist, Reynolds Electrical & Engineering Co., Inc., Las Vegas, Nevada

Skill Requirements—Base for Program Development?
Jerry Plaster, Assistant Professor, Petroleum Technology, Muskingum Area Technical College, Zanesville, Ohio

Joseph Arnold, Dean of Instruction, Muskingum Area Technical College, Zanesville, Ohio

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Petroleum Technology Curriculum—Flexible or Standardized?

Oil Well Servicing
Walter Selvage, Program Director Oil Well Training, Hocking Technical College, Nelsonville, Ohio

Petroleum Technology—Lincoln Trail College
Ed McKay, Petroleum Technology, Lincoln Trail College, Robinson, Illinois

Petroleum Technology—Delgado Junior College
Edward O'Neal, Program Coordinator, Delgado Junior College, New Orleans, Louisiana

Petroleum Technology—Tanana Valley Community College
Dois D. Dallas, Coordinator, Career and Technical Education, Tanana Valley Community College, Fairbanks, Alaska

Industry Assessment of Community College Programs
Wells Rader, Manager Houston Employment Center, Shell Oil Company, Houston, Texas

A. Donald Karecki, General Manager, Book Division, Petroleum Publishing Company, Tulsa, Oklahoma

AFTERNOON

Richard Moorehead, Employee Relations, Cities Service, Tulsa, Oklahoma

Economy of Scale
Joe Piland, President, Lincoln Trail College, Robinson, Illinois

David R. Williams, Jr., Coordinator of Instructional Resources, Santa Barbara City College, Santa Barbara, California

Student Work Experience Programs
Toby Ferguson, Dean of Instruction, Occupational Programs, Northwestern Michigan Community College, Traverse City, Michigan

Dwight Link, Dean of Instruction, Lincoln Trail College, Robinson, Illinois

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EVENING GENERAL SESSION

Wednesday, October 27, 1976

FEDERAL AGENCIES' PANEL

Moderator:
Kenneth Picha, Director, Office of University Programs, U.S. Energy Research and Development Administration

Viewpoint Presentation:

National Manpower Overview
Harold E. Rieve, Chief, Employment and Training Administration, U.S. Department of Labor

Manpower Producer
Walter J. Brooking, Program Specialist, Division of Vocational and Technical Education, U.S. Office of Education

Manpower User
Don Cook, Program Analyst, Office of Federal Activities, U.S. Environmental Protection Agency

Panel Participants:
James R. O'Gwin, Assistant Director, Division of Labor Relations, U.S. Energy Research and Development Administration

Alfred Diamond, Technical Assistant Specialist, Economic Development Administration, U.S. Department of Commerce

Bill G. Aldridge, Program Manager, Modes Task Force, Division of Science Education Development and Research, National Science Foundation

Clifford K. Beck, Assistant to the Director for Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission

Ken Schafer, Economist, Utility Projects Corporation, Federal Energy Administration

Murray Rottenberg, Manpower Development Specialist, Education and Training, U.S. Mining Enforcement and Safety Administration, U.S. Department of the Interior

EVENING GENERAL SESSION

Thursday, October 28, 1976

HIGHER EDUCATION PANEL

Moderator:
Richard E. Wilson, Vice President for Programs, American Association of Community and Junior Colleges

Panel Participants	*State*
Clifford K. Beck, Chairman State Board for Community Colleges	Maryland
John Wright, Vice Chancellor Board of Regents	West Virginia
John Swalee Division of Community College Programs Board of Higher Education	Illinois
Wray Buchanan, Vice Chancellor for Academic Affairs State University and Community College System	Tennessee
Harlan Klintworth, Consultant Board of Vocational, Technical and Adult Education	Wisconsin

APPENDIX E Overview—Legislative Mandates and Program Activities of Participating Federal Agencies

U.S. DEPARTMENT OF LABOR

Agency Participant:

Mr. Harold E. Rieve, Chief, Division of National Training Programs. Mr. Rieve received his undergraduate degree in Economics, Wharton School, University of Pennsylvania, and his LLB from the University of Wisconsin Law School. He formerly was a practicing attorney, insurance executive, and Chief of the Division of Concentrated Employment Programs, DOL.

Legislative Mandate:

The largest portion of the Department's employment and training programs is authorized by the Comprehensive Employment and Training Act (CETA) and is administered by the Employment and Training Administration. The principal thrust of this legislation is the development and administration of local manpower programs designed to meet local needs administered by local prime sponsors. However, Sections 301 and 304 of the Act require and enable the Department to implement, at the national level, employment and training programs which are responsive to manpower problems of national significance. It is in this area that the interest and support of ETA in the field of eneregy lies.

The Division of National Training Programs conducts several groups of programs such as Minority Group Skill Training which includes Apprenticeship Outreach Programs, Journeymen Training Programs, National On-the-Job Training and Promotion and Development Programs. It also conducts Community-Based Programs, School-to-Work Programs and Older Workers Programs. Most programs are conducted pursuant to a contract with or a grant to a national organization to develop training and employment opportunities within a given field, or for a particular segment of the population. National contractors in turn develop local projects to accomplish their goals and those of the Department. These goals, can and should, include training for expanding job categories in the energy field.

Current and Planned Activities:

The Department has long been sensitive to the potential area of national needs in energy-related fields. To that end it has reviewed, but not funded, proposals submitted for training of uranium miners and a proposal to train minorities in nuclear welding. In addition, we are currently giving consideration to a proposal submitted by a prominent university to train for occupations in the areas of (1) solar heating and cooling, (2) coal mining, and (3) nuclear power. In each of these fields the proposer suggests that the occupational specialties for which the most pressing requirements exist are (1) solar heating cooling systems, manufacturing, installation and maintenance technicians, (2) coal mining (deep and shallow) safety inspector, and (3) nuclear reactor operator.

In its consideration of energy manpower training, the Department is governed by two constraints. These are (1) a restriction on the amount of funds available to it, and (2) a concern that there has not been developed any national priorities as to what forms of energy are to be given particular emphasis and in what order. Energy technician training must therefore at best, mark time until national needs for particular job categories are established.

Should funds become available, however, the Department will consider several priorities as to the use of its funds. One of these priorities relates to using CETA Title III resources to award supplementary grants to CETA Title I prime sponsors which will enable them to develop training programs within their jurisdictions which are innovative, replicable and relate to the energy field. Prime sponsors would be selected on a competitive basis based upon proposals submitted in response to a "Request for Proposal." It is our hope that in this way the skill development process for energy manpower resources would be furthered.

A special emphasis of any such RFP effort would be the development of a close relationship between CETA prime sponsors and the Energy Producing Industries. What we would like to see are projects developed jointly by private industry, local colleges and universities, with the overall coordination of a CETA prime sponsor. In this instance, local government would act as a coordinator or expeditor to secure training by competent professionals and employment in the private sector.

EDUCATION AND TRAINING
MINING ENFORCEMENT AND SAFETY ADMINISTRATION
UNITED STATES DEPARTMENT OF THE INTERIOR

Agenty Participant:

Mr. Murray Rottenberg is a Manpower Development Specialist in Education and Training with the U.S. Mining Enforcement and Safety Administration, U.S. Department of the Interior.

Legislative Mandate:

TRAINING AND EDUCATION

SEC. 502. (a) The Secretary shall expand programs for the education and training of operators and agents thereof, and miners in:

(1) the recognition, avoidance, and prevention of accidents or unsafe or unhealthful working conditions in coal mines; and

(2) in the use of flame safety lamps, permissable methane detectors, and other means approved by the Secretary for detecting methane and other explosive gases accurately.

(b) The Secretary shall, to the greatest extent possible, provide technical assistance to operators in meeting the requirements of this Act and in further improving the health safety conditions and practices in coal mines.

ASSISTANCE TO STATES

SEC. 503 (a) The Secretary, in coordination with the Secretary of Health, Education, and Welfare and the Secretary of Labor, is authorized to make grants in accordance with an application approved under this section to any State in which coal mining takes place:

(1) to assist such State in developing and enforcing effective coal mine health and safety laws and regulations consistent with the provisions of Section 506 of this Act;

(2) to improve State workmen's compensation and occupational disease laws and programs related to coal mine employment, and

(3) to promote Federal-State coordination and cooperation in improving the health and safety conditions in the coal mines.

Under this provision there has been developed a State Grant program which has funded several state departments of mines which have in turn utilized funds for the support of mine health and safety programs in community colleges.

Additional programs have been supported with funding

from the Department of Labor and the Department of Health, Education and Welfare. The MESA contribution to these programs has been in the form of assistance with program development and the provision of course material where applicable.

It must be borne in mind that the MESA role is restricted to health and safety education and training and this has traditionally precluded skills training.

NUCLEAR REGULATORY COMMISSION

Agency Participant:

Dr. Clifford K. Beck, Assistant to the Director for Nuclear Regulatory Research, Nuclear Regulatory Commission. Civic responsibility: Chairman of Maryland's State Board for (13) Community Colleges.

Legislative Mandate:

The Nuclear Regulatory Commission (NRC) was created from the regulatory portion of the now non-existent Atomic Energy Commission. The primary NRC function is to exercise regulatory control in behalf of nuclear safety over all aspects of atomic energy. In so doing, appropriate regulatory standards are developed and applied to the location, design, construction, operation, and other aspects of nuclear power and all other regulated atomic energy processes.

Interest of NRC in this Conference:

The role and mission of NRC in behalf of such activities as this Federal agency conference initiated by ERDA in collaboration with AACJC, consist largely in supplying information and guidance on the substantive contents and aspects of Commission policies and procedures that would be relevant to training of students for employment in NRC and the nuclear industry. NRC has no present mandate to contribute financially to training programs in these areas.

A thorough understanding of NRC regulatory functions is essential to the development and implementation of training programs in this area of technology.

U.S. OFFICE OF EDUCATION BUREAU OF OCCUPATIONAL AND ADULT EDUCATION DIVISION OF VOCATIONAL AND TECHNICAL EDUCATION

Agency Participant:

Dr. Walter J. Brooking, Education Program Specialist, Technical Education, Division of Research and Development. Dr. Brooking has been employed in the U.S. Office of Education, Bureau of Occupational and Adult Education, DVTE, for 14 years during which time he has been involved continuously in the development of preparatory materials for post-secondary technician and adult education programs.

Legislative Mandate and Interest:

A. Under the Vocational Education Act of 1963, as amended, to administer the block grants of Federal funds to States for their use in providing high-quality programs of vocational and technical education.

B. Under the Vocational Education Act of 1963, as amended, to conduct research and development under Part C, and to develop curricular or instructional materials under Part I of subject legislation.

Current and FY 1977 Activities:

A. Under the vocational education legislation, provides consultative assistance to the States as they expend Federal and State and local funds according to their State plan under the Act to provide vocational and technical programs which they perceive to best serve the needs of the State.

B. Under Part I of the Vocational Education Act of 1963, as amended, a contract has been let to develop 13 technical specialty courses including a total of 94 instructional modules for nuclear power plant operator trainees. The contractor is the Technical Education Research Centers, Southwest, 4201 Lakeshore Drive, Waco, Texas 76710.

The contract extends from July 15, 1976, through July 14, 1977, and involves slightly less than $240,000.00.

Each module includes an introduction; prerequisites; objectives; discussion topics; materials; procedures; data tables; problems (exercises); reference materials; a module test and illustrations as needed.

Field testing is not included and is expected to follow as an additional contract initiative.

The project builds on a Part C Vocational Education Research project conducted in FY 1976 which identified five types of nuclear technician occupations: Reactor Operator (trainee); Quality Assurance Quality Control Technician; Radiation Protection Technician; Instrumentation and Control Technician; and Nuclear Materials Processing Technician.

U.S. DEPARTMENT OF COMMERCE ECONOMIC DEVELOPMENT ADMINISTRATION

Agency Participant:

Alfred Diamond, Technical Assistance Specialist, Economic Development Administration.

Legislative Mandate:

The Economic Development Administration (EDA) was established under the Public Works and Economic Development Act of 1965 to help generate employment opportunities and improve levels of living in areas that have not shared in the national prosperity.

Under the new Act, EDA is authorized: A. To provide technical assistance which would be useful in alleviating or preventing conditions of excessive employment or underemployment in areas which have substantial need for such assistance. Such assistance may include project plans and feasibility studies, management and operational assistance, and studies evaluating the needs of, and developing potentialities for, economic growth of such areas. B. To furnish to interested individuals, communities, industries and enterprises within such areas any assistance, technical information, market research, or other forms of assistance, information or advice which would be useful in alleviating or preventing conditions of excessive employment or under-employment in such areas. C. To provide funds for demonstration projects designed to foster regional productivity and growth, prevent out-migration, and otherwise carry out the purposes of the Act.

Energy shortages and higher energy costs may lead to curtailment of business and industrial activity and consequent unemployment and under-employment. For this reason, EDA has an interest in efforts to cope with energy problems, including energy resource development, and has supported a variety of projects in the field of energy. Two technical assistance projects relating to energy technology training are the Memphis State University project for the development of manpower for the nuclear industry, and the Colorado State University project to develop model educational courses for architects, engineers and builders, contractors and installers, relating to solar energy systems for residential buildings.

Because of limited funds, technical assistance projects in the field of energy are generally limited to demonstration and innovative projects.

ENVIRONMENTAL PROTECTION AGENCY

Agency Participant:

Mr. Don Cook, Office of Federal Activities, Environmental Protection Agency.

The overall status of Federal support for education and training is that human development funds flowing through USOE and DOL are at the highest levels in history. However, such funds flowing through program-oriented agencies are at the lowest levels in recent years. HUD, DOT, EPA, NASA, ERDA, and others have human resource development authorities, but appropriations and allocations have been relatively low.

Legislative Authorities:

A. EPA's legislative authorities cover eight major areas:
Air Quality
Noise Levels
Pesticide Registration & Use
Solid Waste Management
Water Quality in Lakes & Rivers
Water Quality of Municipal Supplies
Radiation Exposure
Toxic Substances

B. The agency is authorized to develop human resources in many occupational categories using contracts, grants and inter-agency agreements.

Major areas of effort are:

Academic Training. Traineeships and Fellowships for Masters Degrees pertaining to air quality and water quality are awarded. They are limited to employees of State and local environmental control agencies.

Short Course Direct Training. The Air Institute in North Carolina and the National Training Center in Cincinnati offer short duration upgrade courses to professional level employees in pollution control occupations.

Technician Level Training. Two-year associate level training is provided through OJT courses and through community colleges. Occupations such as waste treatment plant operator, pesticide applicator, sanitary landfill attendant, auto emission mechanic and water supply operator are included. Start-up funds for such programs have been provided in recent years and are being ended except in pesticides and water supply.

Needs Assessment. The Energy and Environment Work Force Plan is a project being conducted by the National Field Research Corporation for EPA. The project's purpose is to assess human resource needs by constructing State-by-State profiles on environmental occupations. The results of the project should be of use to post-secondary curriculum planners.

Current Outlook:

EPA has recently concluded inter-agency agreements with the U.S. Office of Education to jointly sponsor post-secondary projects for pesticide, water supply and auto emission occupations. The outlook is for continued dependence on USOE, the vocation education system and others to sponsor and to incorporate training in critical skill areas. The cooperative use of DOL, USOE and EPA funds in conjunction with State and local agencies is the most likely mode of future environmental training.

FEDERAL ENERGY ADMINISTRATION

Agency Participant:

Mr. Ken Schafer is a Labor-Economist in the Utility Projects Office of Energy Resource Development and works directly in the area of manpower shortages affecting energy related projects.

FEA's legislative mandate is contained in Public Law 94-385, as amended, which authorizes the Administrator to develop effective arrangements for participation of State and local governments in the resolution of energy problems and to work with business, labor, consumer and other interests to obtain their cooperation. Labor shortages have been identified as one problem area affecting the supply of energy. FEA is vitally interested in working with other Federal, State, local and private interests to define and mitigate these problems.

FEA is actively pursuing an interagency agreement which would associate ERDA, DOL, TVA, and FEA in providing local area data on energy-related construction projects by specific construction skills. The overall system would also forecast general levels of construction activity on a local and regional basis and the manpower by occupation needed to achieve the forecasted construction volume.

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Agency Participant:

Mr. James R. O'Gwin, Assistant Director, Contractor Manpower, Division of Labor Relations, is responsible for developing and monitoring ERDA policies applicable to contractor personnel compensation programs, employee management relations, education and training activities, and Federal labor standards and regulations. He advises and assists in the development and strengthening of manpower training capabilities of cost-type contractors.

Legislative Mandate:

ERDA's Human Resource Development Activities are directed toward meeting the education and training objectives of the Energy Reorganization Act, Section 103(10) which states that the Administrator is responsible for "helping to assure an adequate supply of manpower for the accomplishment of energy research and development programs by sponsoring and assisting in education and training activities in institutions of higher education, vocational schools, and other institutions, and by assuring the collection, analysis, and dissemination of necessary manpower supply and demand data."

Current and Planned FY 1977 Activities

ERDA's multi-purpose laboratories, production facilities, and Energy Research Centers represent a rich reservoir of technology and training capabilities which can be used to assist the Nation's educational and industrial communities to meet energy manpower needs. A number of manpower programs, including a series of pilot projects supported by the National Science Foundation, and the Department of Labor through the Comprehensive Employment and Training Act, have demonstrated the feasibility of using this supportive approach. Over 300 technical support personnel have been trained and placed with industry in such areas as inhalation toxicology, radiation monitoring, microprocessing, laser optics, nuclear welding, and directional drilling. This is presently an unfunded program but one that may be continued through a number of cooperative efforts in FY 1977.

ERDA does have a small amount of funds in FY 1977 to support topical institutes, short courses on technical subjects and similar activities to enable college and university faculty to acquire expertise in complex energy technologies in a short period of time. Community colleges are eligible to participate in this program.

Current or Planned Inter-Agency Efforts

ERDA is not signatory to any inter-agency agreements dealing specifically with education and training activities. However, a coordinated inter-agency approach appears both feasible and valuable.

NATIONAL SCIENCE FOUNDATION

Agency Participant:

Dr. Bill G. Aldridge, Program Manager, MODES Task Force, Directorate for Science Education, Division of Science Education Development and Research. Dr. Aldridge is on assignment to NSF from Florissant Valley Community College, St. Louis, Missouri.

The Science Education Directorate of the National Science Foundation has a congressional mandate to "Initiate and support ... programs to strengthen ... science education at all levels ...." One of the four major responsibilities of this directorate is to "... insure an adequate supply of high quality science manpower to meet future demands ...." "Science" is defined by the Foundation to include the biological, engineering, mathematical, physical, and social sciences and the history and philosophy of science. Also included are interdisciplinary areas overlapping two or more sciences. Persons educated to work in these sciences have traditionally earned degrees at the baccalaureate, master's, or Ph.D. levels. In recent years, there have been increasing numbers of persons prepared in higher education programs of less than 4 years to work as technicians or technologists in support of scientists or engineers. Courses or curricula to prepare such technicians are eligible for support under certain NSF programs. Since most of these kinds of technician education curricula are offered by 2-year colleges, these colleges have opportunities to receive NSF support for their technician education efforts.

Among the fiscal 1977 NSF programs, there are *several* for which support might be considered for 2-year college energy technician education courses, curricula, or personnel. Some are project-type programs, while others are participant-oriented programs.

SE 77-28, National Needs Science Faculty Professional Development Program

Deadline, January 7, 1977. "... to strengthen their research capabilities in areas of national need, and to increase their instructional competencies in areas concerned with the Nation's problems and their possible solutions." "... up to a year of research and/or other training to either refocus or further develop their competence to contribute specifically to problem-oriented R&D efforts and instruction in these areas."

SE 77-30, Comprehensive Assistance to Undergraduate Science Education

Deadline, December 3, 1976. "The program's primary objectives are, specifically: to strengthen the undergraduate science education components of 2- and 4-year colleges and universities, including technician education"; "to enhance capability for ... continued updating of ... science programs."

SE 77-31, Minority Institutions Science Improvement

Deadlines, December 3, 1976; April 1, 1977. "... assists minority enrollment institutions to increase the flow of underrepresented ethnic minorities into scientific careers." "... for ... designing science curricula ... obtaining laboratory or teaching equipment, developing faculty competencies ...."

SE 77-32, Undergraduate Instructional Scientific Equipment

Deadline, February 4, 1977. "This program addresses the institutional problem of providing necessary equipment as an integral part of improved science education programs."

SE 77-34, Local Course Improvement

Deadline, November 5, 1976. "... focuses on improvement of institutional resources through support of improved course content or structure. ..." Restricted to modest projects (less than $25,000 each).

NSF Chautauqua Short Courses for College Teachers

The primary objective is to make available to teachers "... new knowledge about topics of current interest in such a way that materials will be directly useful in current or planned educational programs." For example, "Solar Energy From an Engineering Perspective"; (AAAS Announcement).

SE 77-50, Science Education Development and Research

No deadlines. Development objectives include those "... to support the development of new 2-year and 4-year science and engineering technician education programs that prepare students for immediate employment." This program requires that a project it supports have national, rather than local or site specific significance, and that the project activity have originality.

The commitment to "Research in Science Education" will include "Research projects in areas of documented importance in which the results have a high probability of directly improving future science education activities and efforts" (of the Foundation).

The Foundation's commitment to technician education does not include support for vocational or occupational training programs for jobs involving routine installation, operation, or maintenance. Only the basic science or technical components of programs for technicians or technologists who work in direct support of scientists or engineers can be considered.

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